The Independent Magazine for Users of Heath/Zenith Microcomputers

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November–December 1985
Issue #19

Hardware and Software Alternatives for Speeding Up the Z100

HDOS: A Software Clock and Other Enhancements

Upgrading the U.S. Robotics S-100 Modem

Installing Dual Drives in the '89

PLUS: Z100 Notebook • BASIC Questions and Answers • Standard Operating Procedure

SEXTANT

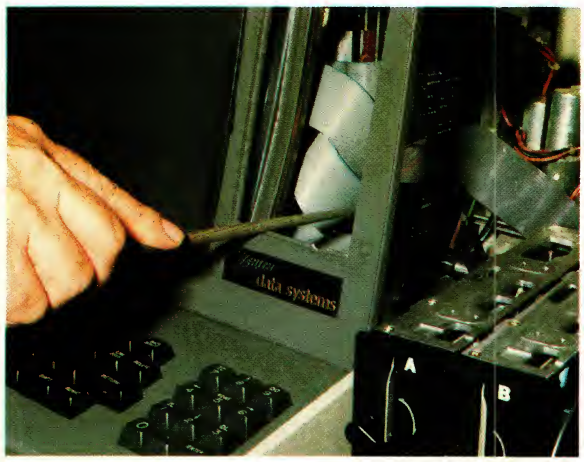

Photo courtesy of Raymond Dotson

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So you've finally decided that two single-sided disk drives just aren't enough. If your disks are hard-sectored, though, you may be reluctant to go out and buy new drives and a new controller. Well, that's not the only solution. You can buy double-sided drives; or you can buy a double-density controller board; or you can buy both. Our author opted for the drives, and he found them remarkably easy to install.

Features

Back for More at HUGCON 4
David R. Felstul 11

RAM Drives for the '100
D.C. Shoemaker 21
Now that the price of memory expansion is coming down, you may wonder, "What would I do with all that memory?" By putting your data on a RAM disk, you can eliminate much of the time taken up accessing disk drives, and the RAM disk fools your program into thinking it's working with a "real" disk. Three RAM disks are discussed here.

Make Your '89 Speak Greek
Ray Albrektson 27
Several issues ago we presented a method for creating an alternate character set on the Z100. The Z100 seemed ideally suited for this task. Well, the '89 is no slouch at it either. Granted, the characters created are not as small as their counterparts on the Z100. But they appear on the screen at the touch of a key. And the MBASIC routine can be incorporated into a larger program, such as a flash-card drill program.

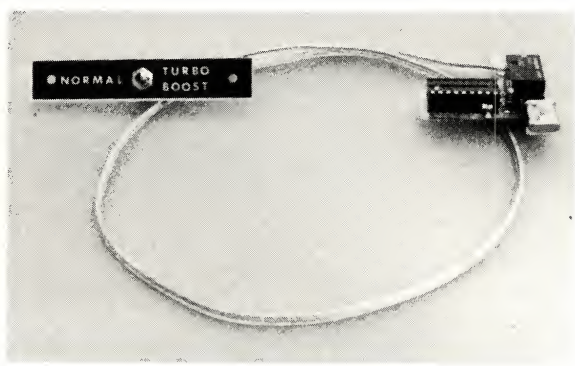

Photo courtesy of Del Scientific

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The main problem designers of speedup modules must cope with is that the faster the speed of the crystal, the more likely it will cause problems with the existing hardware. Del Scientific has hedged against that with their Turbo module, by including a chip for an intermediate speed between 5 MHz and the 7.37-MHz "turbo" speed. And they'll send you a slower chip if that fails.

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Photo by Jennie D. Allen

11 Thirteen hundred HUG members converged on Chicago again this August for the Fourth International HUG Conference. There was plenty to see and do. Besides the five new computers from Heath, there were emulator boards, desktop utilities, and lots of discounts, seminars, and prizes.

HDOS Enhancements from T & E 33
Robert Page Carter
T & E associates have a strong reputation in the Heath world for their support of HDOS. Their HDOS Enhancements are one reason why. These utilities streamline some of the more tedious tasks associated with computer use.

More Disk Capacity for Your '89 57
Raymond Dotson

Del Scientific Speeds Up Your '100 63
Jeffrey Goldman

A Software Clock for HDOS 67
Charles Horn
A software clock doesn't keep time between sessions. Aside from that one drawback, though, there are only benefits. It's easy to install. It doesn't have to interfere with the computer's other functions. Best of all, you don't have to write the code—this one's been written for you.

Upgrade an Internal Modem for Your '100 77
Charles Layman
U.S. Robotics' S-100 modem installs, as you might guess, on the Z100's S-100 bus. It's a "smart" modem, and it includes an auto-answer feature: if the phone rings while the computer is on, the modem will try to answer it. You might not always want that. Presented here is the circuitry to modify that feature, as well as some improvements to the modem's speaker and some modifications to its initialization software.

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Cover photo courtesy of Henry Tourneur/Brussels

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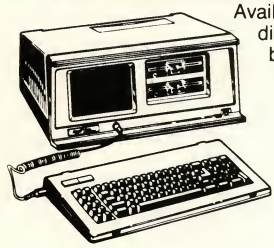

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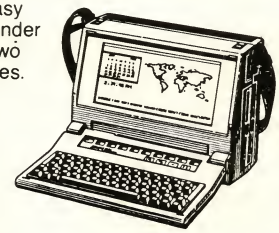

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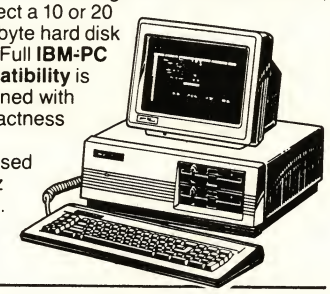

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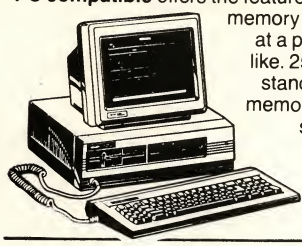

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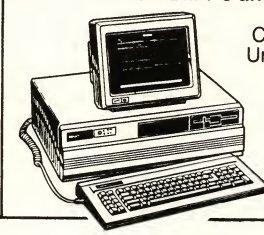

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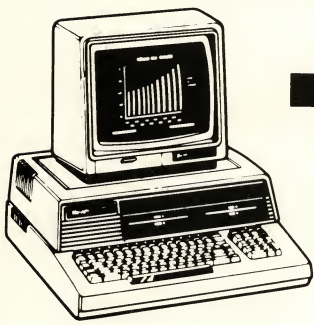

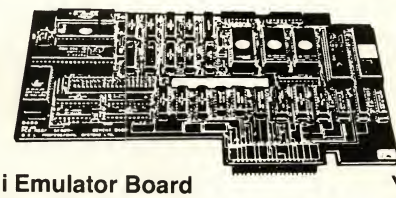

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The Editorial Eye

In August, Sharon Conaway left Sextant Publishing Company to continue her education on a more structured basis. She'd been here almost four years, since the early days of our work on the magazine. As one of *Sextant*'s initial crew of four, Sharon had a great influence on the development of the magazine. One of her early contributions was designing the Table of Contents.

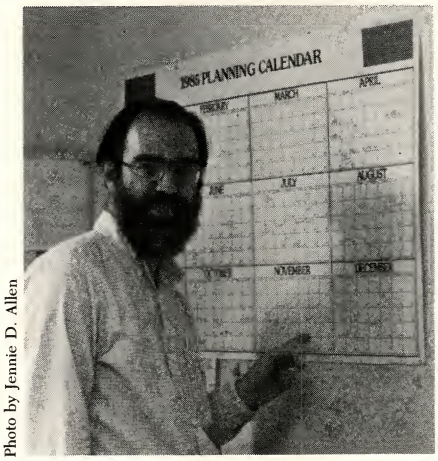

Photo by Jennie D. Allen

Sharon also helped me hire most of our current staff. In particular, she recruited John Gill, who has taken over from her in the areas of subscriber services and producing the magazine.

During the past couple of years, Sharon devoted a lot of attention to two efforts: building our circulation and increasing the amount of advertising in *Sextant*. Shortly before leaving, she asked me whether I had any project of comparable significance in mind for the future.

In fact, Managing Editor Jennie Allen and I had recently begun discussing improvements in the mix of articles we're delivering to our readers. One of our goals is to provide more timely coverage of topics of general interest to the Heath/Zenith community. Most of the results of this effort will reach you in 1986. However, we were able to expedite publication of our article on the International Heath/Zenith Users' Group Conference. (See page 11.) It may not seem very impressive to report on an August event in the November-December issue. But last year's HUGCON was in July, and our article on it didn't appear until the January-February 1985 *Sextant*.

Two more weekend conferences for users of Zenith Data Systems and Heathkit® computers are coming up in November. The first is just a subway trip from our office. The Crystal City Hyatt Regency Hotel in Arlington, Virginia, will be the site of CHUGCON 85 November 2-3. The Capital Heath Users' Group has a recorded announcement with details (in English, not ASCII) at 703/339-9857. Among the reasons CHUGCON manages to draw a couple of thousand people are free admission and ready access by car, train, bus, plane, or subway.

Two weeks later, some of us will be heading to Anaheim, California, for the Western Regional HUG Conference at the Disneyland Hotel. It's set for Friday afternoon through Sunday noon November 15-17. (Details from Western Regional HUG Conference, 1555 North Orange Grove Ave., Pomona, CA 91767.)

Both regional conferences feature technical seminars, vendor exhibits, and opportunities to meet other Heath/Zenith users. The Virginia and California locations offer a nice balance to the international HUG conference in Illinois.

Having these two regional conferences in November is a bit tough on the vendors who would like to exhibit at both of them. I hope next year's CHUGCON will be in October—the only month of the year I can enthusiastically invite people to enjoy the weather in this area.

Charles Floto

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Letters

Directory Shells

The thing I enjoyed most about the September-October issue was the article entitled "The Quest for the Ultimate Word Processor" by Kenneth W. Daniel. What caught my eye was the statement near the first of the article regarding Autoscribe on the (then) new H89. This was about the time I got my H89, and I had purchased Autoscribe with it. Seems to me I paid a pretty penny for Autoscribe, too.

I agree with the author that the best part of Autoscribe was its directory shell, which I still miss very much. When Autoscribe disappeared from the Heath catalog and Heath/Zenith stopped supporting it, I switched to WordStar. These are the only two word processing programs I have used to any significant extent, so I cannot claim as broad experience as Kenneth Daniel, but I too have scanned nearly every new word processor article and advertisement I've come across, looking to see if it listed a directory shell feature similar to that of Autoscribe. No luck.

I have, however, incorporated into my WordStar writings the next best thing I could think of which provides the same features as Autoscribe's directory shell. To do this I create a WordStar file which I name "INDEX". Before I start writing a document, I call up INDEX and add a line which includes the file designation, date, and description of the document. For the file designation, I start with 01, then progress to 02, etc.

Perhaps someone can come up with an enhancement to WordStar which would automatically cause a similar index to be created, and added to when the user starts a new document.

Another WordStar enhancement on my wish list would be ruler lines which become recorded along with the document on the disk. Should the document be recalled for further editing, the ruler lines used during creation of the document would each appear according to the position of the cursor.

I could dream up several more things about WordStar I wish were different, but such a list could go on for many pages. As far as I'm concerned, these two are the most important.

James G. Barr
Littleton, CO

More Corrections to Auto Key Repeat Circuit

The following errors were found in the figures and tables of the article "Add Automatic Key Repeat to Your '89 or '19" (July-August 1985):

In Table 1, under "Miscellaneous": "two-conductor wire for power (2″)" should read: "two-conductor wire for power (24″)."

In Figure 2, on the right-hand side where it shows gate U1c, it indicates pin 7 as going out to P301, pad 31, and should indicate pin 4 as going out to P301, pad 31.

In Figure 3, in the blow-up of the top side of the PC board showing the "in" and "out" hole positions, the holes are marked improperly. The hole marked "in" should actually be marked "out" and vice-versa for the hole marked "out."

One final note: In Table 1, it would have been helpful to indicate that a 2-lug terminal strip with "isolated terminals" should be used and not the other type where one lug goes directly to ground.

Dan Agnew
McAllen, TX

Volume Control for S-100 Modem

I have often found it is next to impossible to hear the dial tone and/or busy signal above the Z100 fan noise when using my S-100 modem. With the purchase of a ZVM-135 color monitor, I discovered that I could use the audio input to the small button speaker on the S-100 modem and redirect this to the audio input of the monitor. I placed an audio jack on the S-100 board and a .01 capacitor (may not be needed) from signal input to button speaker to the jack, then wired jack ground to button speaker ground. Next connect standard audio cable between modem and monitor. Now I have volume control for my modem, but best of all, I can hear what's happening, and it cost less than $5.

Lt. Col. Myles P. Somers
Norfolk, VA

For more upgrades to an S-100 modem, see "Upgrade an Internal Modem for Your '100," on page 77.

Upgrades Would Show Heart

I always enjoy Alison Phillips' "Z100 Notebook." It is informative, educational, and well written. However, one part of the July-August article, "Gift certificates show heart," concerned me. If ZDS really does have a heart and a sense of fair play, it should offer an upgrade program for the Z100, especially to those people who bought the early models at a time when everyone else was buying an IBM PC.

My Z100, which was purchased in December 1983, has a noisy fan, and I have to turn the machine off after a while to give my ears a rest. I have heard that there is a new power supply with a better designed fan made by ZDS. But it costs $250 or $200 if you give them your old power supply—with which there is nothing wrong except that ZDS did not design the fan exit big enough to handle the volume of air the fan moves. These days, ZDS is talking about the upgrade kit (HA-108) which allows the Z100 to run at 8 MHz and use the 256K chips on the motherboard. Again, however, this kit is only for the latest models of the Z100; so, if your Z100 has an 85-2653-1 motherboard, you are one of the unfortunates who read the installation article for the older motherboard (published in the July issue of *REMark*) and decided not to update the motherboard, either because you may lose your $1,000 board, or because it would cost you too much to have an experienced person install it for you.

I congratulate Alison Phillips for the $350 gift certificate, but if ZDS does have a heart, it should offer those of us who own Z100s with noisy fans and the 85-2653-1 motherboards an upgrade program which allows us to exchange those parts at reasonable and fair value.

Aly H. Shaaban
Garner, NC

Note: I am interested to know how Mr. David S. Pedejko updated his Z100 to the 8088-2 ["Letters," *Sextant* #17]. The Intel 8087-2 coprocessor is now selling for $119.

Nothing But a Runaround

In the July-August 1985 issue of *Sextant*, Alison Phillips (no relation), professed the same aggravation with Zenith Data Systems that I did when ordering my Z100 through GEA. Except, my letters and phone calls got me nothing but a runaround. I had my Z100 almost half paid for before it arrived (and at 12.5% APR). The waiting time was almost exact (March-July 1984). Please have Alison tell how he got $350 in gift certificates from ZDS. I certainly could use some. I would settle for MS-DOS Version 2, or even a letter from ZDS saying "Sorry, here's a check for the interest you had to pay while waiting for our supply to catch up with the demand." I've done all I can.

By the way, *Sextant* and *Buss* publications are the greatest. Keep up the good work!

Gary L. Phillips
Maxwell AFB, AL

Software Availability: Z100's Advantage

I have had my Z100 for almost a year, but I am only now beginning to realize that one of the major advantages of owning it, rather than a PC clone, is software availability. This sounds ironic, but here is what I mean:

Of the basic business software requirements, the big-name, high-cost packages are well represented: WordStar, Lotus 1-2-3, dBASE II, and many others.

But it is amazing how much high-quality, low-cost software is being produced and supported for the Z100 by the smaller, but no less talented, companies. I have recently been tremendously pleased with purchases of Hilgraeve's ACCESS for communications, and S & K's WatchWord for word processing. Both are, in my opinion, easily superior to their competitors, yet cost very little. There are equivalent examples for other categories of software.

Of course, in the hobby-software category, there are outstanding national, regional, and local H/Z users' groups which seem to produce an exceptional number of well written public-domain programs.

I will grant enthusiasts of other brands of computers that the Z100 will not run nearly as many programs as some other 8088-based machines. But since it seems to run the best program in each category, that point is moot. Further, since most of those programs run better on the Z100, and others of them run only on the Z100, the advantage seems to be ours.

To the likes of Hilgraeve, S & K, HUG, Barry Watzman, *Sextant*, and Software Wizardry: Thanks, and keep up the good work!

David M. Tucker
Mobile, AL

More On the Imaginator

In researching our article on the Imaginator graphics board ("Great Graphics for the '19 and '89," *Sextant* #16), we tried to cover all aspects of both hardware and software. Unfortunately, we were not completely successful—especially with equipment that neither of us has access to!

The Imaginator requires the original Heath Terminal Logic Board ROM to operate. It is not compatible with replacements such as the Super19 or Ultra ROM. Illustrator is not available for the CP/M operating system. It is only available for HDOS and for the Z100 running either Z-DOS 1.25 or MS-DOS 2.0. The 1984 and 1985 editions of the *Buss Directory* stated that Illustrator is available for CP/M, but this is incorrect. According to WIzard Software House, Illustrator requires 56K of RAM for HDOS, and will run in 128K on a Z100 but prefers 192K.

We would like to thank Robert F. Hassard (*Buss* #108) and Ross Whistler (*Sextant* #17) for bringing these matters to our attention. We do, however, take small exception to one point mentioned by Steve Leache in his letter published in issue #17 of *Sextant*.

The programs that Mr. Leache describes sound very useful for the CP/M user. Since there is no other reasonably priced CP/M software for the Imaginator, these programs seem worthy of serious consideration.

However, Illustrator is the only software available for the Imaginator board running in HDOS. We have found this to be a very worthwhile program. Mr. Scott has used it extensively in the

If you have a Z-100, treat yourself to some

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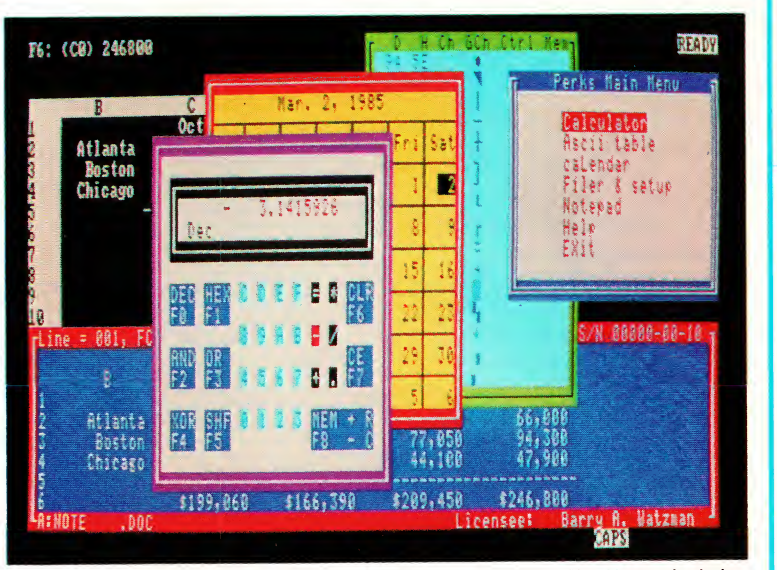
Perks is the background desktop utility program for Z-100's featuring full-color windows, a calculator, a notepad, an ASCII table, a Filer, a screen saver, alarm timers, context sensitive help screens and a calendar with an appointment schedule. Perks works with all Z-100's having 192K or more of memory and using the Z-DOS/MS-DOS 1.X or 2.X operating systems.



Shown above is an actual screen photo of Perks in operation. The Notepad window contains data "imported" from the Lotus 1-2-3 worksheet being prepared when Perks was activated.

Here are some actual unsolicited comments from customers:

"My heartiest congratulations and thanks for a fine product. I expect that Perks will be the best software dollar I have yet spent, and I have spent lots. Anyone with a Z-100 should run to buy Perks"

"I know I said this over the phone, however, once again I would like to thank you for a GREAT product."

"You're the best friend a Z-100 ever had! Mine loves Perks, and I want to thank you for the prompt filling of my order. Perks is everything and more than I thought it was going to be. The Notepad function alone is worth the price. And to think, I'd thought about buying a Programmer's Calculator from Hewlett Packard! Yours does everything I'd have used HP's for. Your Program is simply beautiful and elegant."

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preparation of schematic diagrams, and Ms. Morton has used it for mapmaking. Unlike Mr. Leache, not all Imaginator users have the skills necessary to write application software for the board in a fast language such as C or Assembler. For these users, especially those who prefer HDOS, we feel that Illustrator is ideal.

The moral of all of this is that whenever contemplating the purchase of any hardware or software, a thorough investigation should be made. In this case, both Cleveland Codonics and WIzard Software House are available via telephone, and are capable and willing to answer questions concerning hardware, memory, and compatibility requirements of their respective products.

In case anyone is interested, the Imaginator works fine with an H89 CPU that has been modified to run at 4 MHz. It will also work with a terminal logic board that has been modified to run at 3 MHz to communicate with the CPU at 19,200 baud. However, the Imaginator will not operate with a 4-MHz terminal logic board.

Karen D. Morton
Walter M. Scott, III
Knoxville, TN

Don't Use PATCH on DIRECT.SYS

Thanks for the advance copy of *Sextant* #18 containing my article ["Menu Control with HDOS MBASIC"]. It appears very well done with only one error of any consequence. On the third page, it makes reference to the Heath program PATCH.ABS as a means of removing the "L" flag from SYSCMD.SYS. This *will not work.* PATCH.ABS is only used to patch .ABS object files and *cannot* be used for patching DIRECT.SYS, GRT.SYS, or RGT.SYS. When it is tried to patch these files, it returns the error that the file's contents are not correct for this operation. When you think about the philosophy of HDOS's protecting itself from the user, this is quite good, but it makes life much more difficult for those like me, who like to get into the system level programs. UDUMP or DUMP.ABS from HUG's disk VIII will have to be used.

The byte to patch is byte 0E hexadecimal (first number is zero) of the entry for SYSCMD.SYS in the dump of DIRECT.SYS. This byte should be patched to 00 to remove all file flag attributes. I hope that this error does not cause too much confusion. Pat Swayne's FLAGS program is much more convenient, but since it rewrites DIRECT.SYS, it is also *much more dangerous* and should be tested on a non-critical disk first.

By the way, the Radio Shack phototransistor called for in the Ray Albrektson's dimming circuit is no longer stocked by Radio Shack. Instead, an essentially equivalent part is available as part of their Archer Infrared Emitter and Detector kit, part #276-142.

Dr. Rick Streeter
Bigfork, MN

Redirect Directory to File

The letters you have been publishing recently about MS-DOS version 2.xx have been a great deal of help to me, especially the ones concerning silencing the key click on the Z100. Reading through my MS-DOS manual I came upon something that would be useful if you wanted to make a master directory of all of your disks without having to manually enter all of the directories (you can't copy a directory from one disk to another using the COPY command).

To do this, place your destination disk in drive A and your source disk in drive B. With A as the default disk, enter:

DIR B: >XXXXX.DIR

You will then have a file on drive A named XXXXX.DIR containing a listing of the files in the directory. If anyone knows how to do this under Z-DOS version 1.xx, I would appreciate the information.

I'm also going to add my 2 cents about the quality of Zenith's MS-DOS

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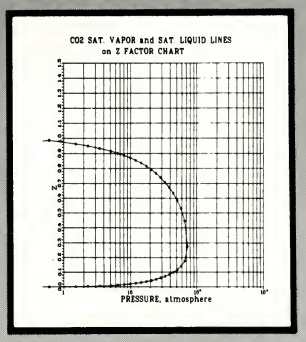

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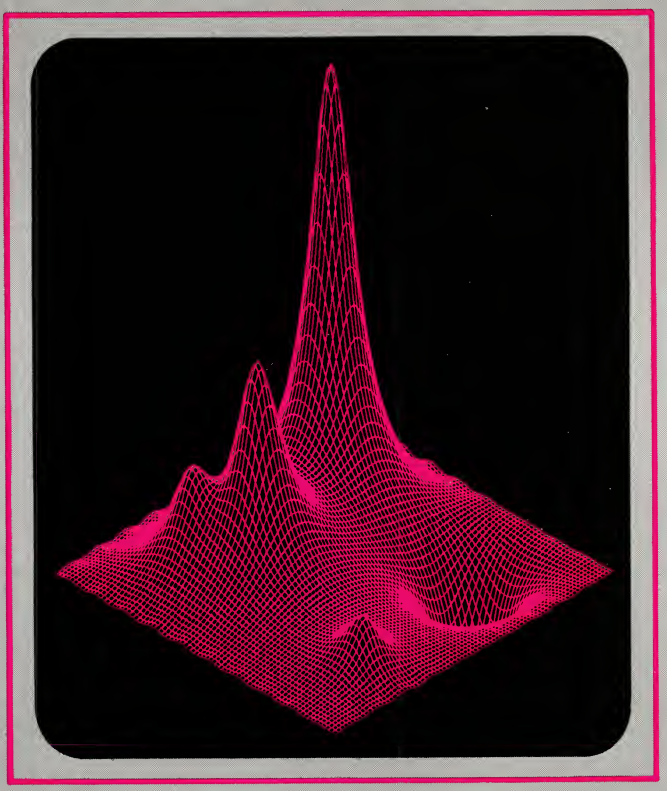
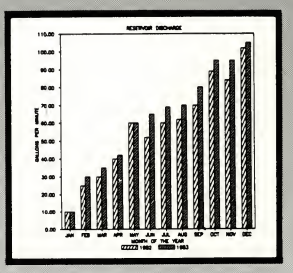
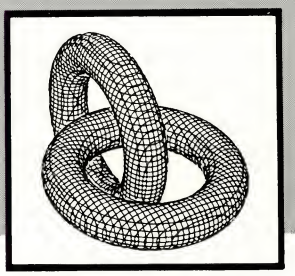


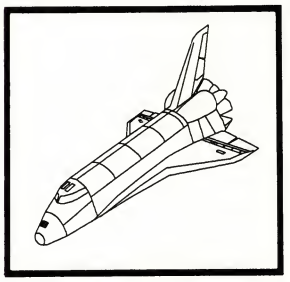


Business Graphics

Contouring



Program Output



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Press one key and, even when you're absent, operators of remote terminals or computers can access your computer by entering passwords you define. You can set whether each password allows a user to read or type messages, transfer files, run a given program, or use your operating system and all your programs.*

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For PC-compatibles and Z-100 computers with DOS and any modem, including 2400 baud and USR S100 modems. You can get HyperACCESS for $149 from computer dealers or from Hilgraeve Inc. (please specify computer and add $5 shipping).

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†Hilgraeve and its dealers will continue to sell ACCESS, as well.
HyperACCESS and ACCESS are trademarks of Hilgraeve Inc.

*Certain programs cannot be operated remotely.

documentation. I have found it to be excellent and extremely helpful. Before I purchased my Z100, I had no experience with microcomputers but was able to jump right in the documentation provided. My boss just purchased an IBM PC XT and his documentation is, to be polite, somewhat skimpy and not particularly helpful.

I like the logo you have started putting at the end of your articles and as a navigator, I understand the significance of it, but I'm sure that a lot of your readers don't. How about a quick explanation in the Editorial Eye next issue? Keep up the good work.

Robert R. June
Grand Forks AFB, ND

P.S. Special thanks to Alison Phillips for the info about the ">" character contained in the "Z100 Notebook" in the July-August issue!

Fewer Z-BASIC Colors

In his article, "Making Z-BASIC More Colorful" (July-August issue), Sidney Hack somewhat overstates the number of different colors which can be displayed with two- and three-pixel combinations on H/Z100s with color monitors.

As Hack explains, at each pixel location you have the option to turn on or off each of the three primary colors, red, green, or blue. Thus, each color has two possible intensity levels, on or off. This gives 2x2x2 = 8 possible one-pixel colors, which are the ones you can call out with the standard Z-BASIC commands.

If you combine pixel pairs, then you have three possible levels for each color: no pixels on, one on, or two on. Thus, each pair can have three levels of each of the three colors, giving 3x3x3 = 27 combinations. The reason for the difference between 27 and the 36 colors mentioned by Hack, and shown in his Figure 1, is that some combinations of the Z-BASIC colors are identical. Displaying half the pixels as magenta and half as black (Z-BASIC colors 5 and 0) is the same as displaying half as red and half as blue (colors 4 and 1). Individual monitors may produce slight differences in these two cases, but they should appear as essentially the same color.

	Pixel 1	Pixel 2	Pixel 3	Pixel 4	Pixel 5	Pixel 6	Pixel 7	Pixel 8	Pixel 9
7,0,0:	RGB	—	—	RGB	—	—	RGB	—	—
	RGB	—	—	RGB	—	—	RGB	—	—
	(etc.)								
1,2,4:	R—	G—	B—	R—	G—	B—	R—	G—	B—
	R—	G—	B—	R—	G—	B—	R—	G—	B—
	(etc.)								

Figure A.

The enclosed short program (Listing A) displays the 27 two-pixel colors on a three-plane projection of the "color cube." The increasing degree of saturation as you approach the corners of the cube is quite evident.

With pixel triads each color may have zero, one, two, or three pixels turned on, giving four choices per color. The total number of distinct combinations is then 4x4x4 = 64. Eight of these, at the corners of the color cube, are the same as the corners of the 3x3x3 or the 2x2x2 cubes. The total number of one-, two-, and three-pixel colors is therefore 8 + (27−8) + (64−8) = 83, not quite the "more than 100" mentioned in the article.

The new GW BASIC now being sold by Heath/Zenith for the '100 has the capability of specifying a "tiling" bit pattern in each of three colors. The tiling pattern is used for area fills. A very large set of textures and colors may be produced in this way. Three-pixel combinations are not possible, because the tiles are eight pixels wide, but four-pixel colors may be made. The total of these is 5x5x5 = 125.

Alan T. Moffett
Los Angeles, CA

Sidney Hack replies

Mr. Moffet makes a nice point that would seem to be unassailable. But his conclusions miss the mark.

Magenta is indeed composed of blue and red points. But how those points are spaced can, and does, make a difference in the resulting color. I can best illustrate by using an example of a pattern of three vertical adjacent colored lines. Consider the two arrangements 7,0,0 (white, blank, blank) and 1,2,4 (blue, green, red) for adjacent lines.

The screen representation would be as shown in Figure A.

Both arrangements have the same numbers of red, green, and blue points—but the resulting colors differ. And, surprisingly, adjacent lines in 1,4,2 sequence produce yet another shade!

How many obviously different colors can be produced with three vertical adjacent lines? I'm still not certain—but I know that my figure of 100 is a conservative one.

I am sure about the 36 figure for two adjacent lines. There are eight possible states for each of the two horizontally adjacent pixels: ..., R.., .G., ..B, RG., R.B, RGB. Thus, there are 8^2 or 64 combinations. Of the 64, eight are unique, while half of the remaining 56 duplicate others in effect. The complete calculation is: $8+(8^2-8)/2 = 36$.

Sidney Hack
Columbia, SC

```
100 ' PALETTE -- Program to show the 27 possible two-pixel colors
110 '  as a 3x3x3 array.
120 '
130 ' Alan T. Moffet,  13 July, 1985
140 '
150 ' Load the Palette Table
160 DIM C1(27),C2(27)
170 DATA 0,1,1,4,4,5,4,5,5,2,2,3,4,5,5,6,6,7,2,3,3,6,6,7,6,7,7
180 DATA 0,0,1,0,1,1,4,4,5,0,1,1,2,2,3,4,5,5,2,2,3,2,3,3,6,6,7
190 FOR I = 0 TO 26 : READ C1(I) : NEXT I
200 FOR I = 0 TO 26 : READ C2(I) : NEXT I
210 '
220 ' Draw and label the Axes
230 CLS
240 LINE(196,133)-(196,5),7 : LOCATE 22,1 : PRINT "R";
250 LINE(196,133)-(0,182),7 : LOCATE 1,26 : PRINT "B";
260 LINE(196,133)-(638,149),7 : LOCATE 18,80 : PRINT "G"; : LOCATE 1,1
270 '
280 ' Fill in the Palette
290 FOR I = 0 TO 26 STEP 3
300   X = 195 - 64*((I/3) MOD 3) + 208*INT(I/9)
310   FOR J = 0 TO 2
320     Y = 132 - 40*J + 16*((I/3) MOD 3) + 8*INT(I/9)
330     L = I + J
340     FOR K = 0 TO 63 STEP 2
350       XL = X - K
360       YB = Y + INT(K/4)
370       YT = YB - 40
380       LINE(XL,YT)-(XL,YB),C1(L)
390       LINE(XL-1,YT)-(XL-1,YB),C2(L)
400       NEXT K
410     NEXT J
420   NEXT I
430 STOP
```

Listing A.

Correction

The Capital Heath Users' Group has changed its address. The old address was given in "Z100 Notebook," *Sextant* #17. The new address is P.O. Box 16406, Arlington, VA 22215-1406, 703/339-9857 (recorded message).

The H89 *SPEED* Center

4MHz mod $45

An easy to install plug-in module. No trace cutting or soldering. Speed may be toggled with software. Includes a replacement Z80A (4MHz). Software supports Heath CP/M 2.2.03 and 04 and CDR Systems BIOS. Call or write for support of other BIOS orHDOS. Specify disk format.

6MHz mod $59

Similar to our 4MHz modification, but increases the CPU speed to 6MHz. Requires some soldering on the CPU circuit board. Includes a Z80B (6MHz) CPU replacement. Some technical knowledge is recommended for installation. Call or write for more details. Specify disk format.

CDR Super RAM 89

Make your H89 a speed whiz with this board and the included RAM drive software. With our 6MHz mod and the RAM drive, the Heath BIOS assembles (using MAKEBIOS) in less than 1½ minutes! Note our discount prices!

Main board w/o RAM - specify disk format.....$175
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Clock option.....$45
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CDR Controllers

Double density disk controllers. Includes board, instruction manuals, ROMs and software. Allows control of 5 and 8 inch drives. Includes BIOS source code and some useful utilities. Please include your CP/M s/n when ordering.

For the H89 FDC-88OH.....$349
For the H8 FDC-H8.....$429

REP3 - Automatic Key Repeat

Stop wasting time - make full use of the repeat function just like the Z100. Simple plug-in installation on your keyboard assembly. Hold any key down for half a second and the key begins repeating. Combine this with our 4MHz mod and make WordStar fly! Provision for a defeat switch.

Kit.....$35
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TIM2 - Real Time Clock

This circuit installs in the left hand expansion slots of the H89 or H89A. Can provide application programs with time and date information. Includes battery backup for continuous timekeeping when the computer is turned off. Program access to the clock is through an I/O port. The port address is user selectable by means of a jumper. Requires soldering 4 wires to the CPU board. A prepared ribbon cable is included.

Kit.....$65
Assembled.....$75
Software on disk - specify disk format.....$10

DATESTAMPER

Product of Plu*Perfect Systems. Provides automatic time and datestamping for CP/M 2.2 files. Works with many real time clocks, including our own TIM2 product.

CP/M - specify disk format.....$45

WSPATCH $20

Adds H19/H89 function key patches to versions 3.0 or 3.3 of WordStar. Key functions similar to the PIE editor. Includes provision for redefining the keys by the user. Also includes a printer driver for the Epson MX80/FX80 printers.

NEWWORD - the better word processor from NewStar Software

Faster than WordStar, same commands as WordStar, MailMerge feature is built-in, supports more printers, has an undelete function and excellent documentation. We offer it at a discount and also include a function/cursor key patch for the H19/H89. Part of the bundled software is the WORD plus spelling checker from Oasis - normally a $150 item by itself!

CP/M - specify format.....$85
CP/M with the WORD plus.....$135
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EMULATE

Allows the H89 to read/write to the following disk formats.

Actrix	Eagle II	Morrow MD	Superbrain Jr.
AMPRO	Epson QX-10	NCR DecMate 5	Televideo
Beehive Tpr	Fujitsu CP/M86	NEC PC-8001A	TRS80-1 CP/M
CDR	IBM CP/M86	Osborne 1	TRS80-3 CP/M
Cromemco	IMS 5000	Otrona	TRS80-4 CP/M
DEC VT180	Kaypro II	PMC MicroMate	Xerox 820
DEC Rainbow	Magnolia	Sanyo 1100	Zorba

Now includes 42 formats! Uses a modified version of CP/M 2.203 or .04 BIOS which is included with the program. Allows the use of virtual drives and reading of 40-track disks in an 80-track drive.

For H37 with Heath CP/M.....$59
Check for C.D.R. and Magnolia versions.

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High quality private label diskettes at an economy price.

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Back for More at HUGCON 4

But still no HDOS 3.

David R. Felstul

Photo by Jennie D. Allen

Members of the Heath Users' Group did it again this year at the Fourth International Heath/Zenith Users' Group Conference. HUGCON 4 was held on August 9-11 at the Hyatt Regency O'Hare in Chicago, almost within sight of the world's busiest airport. They were three days filled with too much to see, too many people to talk to, and not enough money to buy everything you wanted to.

For those of you who couldn't be there, here is a quick alphabet primer of all you missed. (Or at least most of it. The editors wouldn't let me have the whole issue to myself, so I had to leave some things out.)

A is for Awards.

Bob Ellerton, Heath Users' Group manager, presented four service awards at Friday night's grand opening. For the past two years, the award for Club of the Year had gone to the Washington, D.C., area's Capital Heath Users' Group. This year, Pomona HUG took the crown away from CHUG, in part due to Pomona HUG's excellent job of organizing last year's Western Regional HUG Conference. (See "HUGCON West Takes Off" by Mark Goodkin, in *Sextant* #16, May-June 1985.)

Dave Troendle of New Orleans General Data Services received the Vendor of the Year award. Dave had to wait until Saturday to pick up the award, though, since he reportedly slept through the award ceremony during Friday night's opener. Troendle and NOGDS have provided support for the Heath community since he designed the first color graphics board for the H8 back in 1981.

Bruce Denton of D-G Electronic Developments received a lifetime membership in HUG for his years of support for Heath/Zenith products.

HUG's answer man, Mike Cogswell, was presented with the Outstanding User award. Mike's the one who writes all those software patches that you see posted on the HUG bulletin board on CompuServe. Among other things, he's the one who designed the modification that made possible the 256-kilobyte upgrade for older Z100s. (It was published in the July 1985 issue of *REMark*, in Pat Swayne's article "Installing the HA-108 Upgrade Kit on Older H/Z-100 CPU Boards.")

B is for Business tools.

I was disappointed by the "Business Tools" seminar offered by Terry Jensen, formerly HUG's software developer and now a private software consultant. Jensen talked about word processors, spreadsheets, and data base managers, as well as touching on several other areas. He was well organized, but he simply didn't have first-hand knowledge of many of the products available.

On the other hand, I was impressed by the amount of business software that has become available for those in the Heath/Zenith community. Of course, much of our new-found wealth is the legacy of the IBM Personal Computer, and runs on our PC clones. However, much of it has also been redone for the '100 and some has been written exclusively for the '100. The '89 has not been forgotten, either, although it may not have as much glamour for software developers.

C is for Computers, a large part of what HUGCON is all about.

Zenith Data Systems (ZDS) was showing off their newest computer models at

the conference—all of which continued their trend towards IBM compatibility. Mark Foster, a hardware engineer from Zenith, was on hand to give a couple of seminars on the new models.

Out of the five computers Zenith showed, only two were impressive; the others seemed rather average. The Z138 and Z148, for instance, are the transportable and low-budget versions of the Z158, heir apparent of the Z150, Zenith's IBM Personal Computer clone.

All three run at either 4.77 megahertz or the faster 8 MHz. Also, to squeeze down the circuit board size and further increase the speed of operation, Zenith custom designed some of the integrated-circuit (IC) chips. However, the '138 and '148 lack the expansion slots that make it so easy to add more hardware to a machine. It's a tradeoff—they're smaller and less expensive, but harder to expand.

The '158 is an improvement over the '150, but then that isn't hard, seeing how closely the '150 emulates the limited IBM PC. The '158's desirability is helped by its two operating speeds, 4.77 and 8 MHz, and its condensation of the '150's four circuit boards into two—but there's only so much you can do with the basic design.

One new Heath/Zenith offering picked up some attention even though it wasn't being showcased: the ZP150. This laptop is an interesting concept, albeit an obvious takeoff on Hewlett-Packard's 110. (It isn't a Zenith design, by the way. A Japanese firm, Mitsui, manufactures it.) The ZP150 is a sleek, attractive machine that easily fits into an attache case. Unfortunately, it just isn't a "real" computer.

The ZP150's worst shortcoming is the lack of any floppy drives or at least the ability to work with them. I know the read-only memory (ROM) based operating system and software, Microsoft Works, is supposed to take care of all my needs. But what if I don't want to use Microsoft's Word as my word processor? (Especially since the laptop version is missing a few of the desktop version's features.)

Furthermore, I refuse to believe that the software market will stand still for long. With no disk drives or regular input/output (I/O) capabilities there is no way to take advantage of new products or even existing special applications programs. As Mark Foster, the Zenith hardware engineer, put it in his seminar, "People are scared because it doesn't have disk drives."

The ZP150 comes with only 32 kilobytes of random access memory (RAM)—although reportedly you can upgrade this to 406K with 32K modules. The built-in modem communicates at only 300 baud, and so far I am unaware of any plans to offer a 1200-baud upgrade. These limitations in a closed-architecture machine sound like building in obsolescence to me—like a certain Apple, perhaps?

Okay, okay. To be fair, Heath/Zenith doesn't bill the ZP150 as a fully stand-alone computer. The idea is that you can hook it up via its modem to your "real" '150—the desktop one—in the office. The ZP150 has a suggested retail price of almost $2,000—for which I'd want a "real" one. The actual selling price, though, is more attractive: as low as $995.

Perhaps feeling it had a limited market, ZDS decided not to officially offer the ZP150. Instead, it's being offered only through the Heath/Zenith Computers & Electronics stores. Maybe they think the Heath community will be more tolerant of the ZP150's shortcomings. (There are also rumors that Zenith purchased only a limited number of the machines and just wants to get rid of them.)

Zenith's other new portable, the Z171, at less than twice the cost of its sibling, has to be at least ten times the machine. True, it weighs almost twice as much as the 7.7-pound ZP150, but 15 pounds is still a lot lighter than Zenith's previous attempt at portability, the 42-pound H/Z160.

The '171 comes with 256K of RAM (expandable to 640K) and two disk drives. It also has a full-size 25-line thin screen instead of the ZP150's 16-line one. The '171's liquid-crystal display (LCD) is backlit, too, so you can read it—if not perfectly, at least more easily than the ZP150's standard LCD display. The '171 will even simulate color graphics, displaying them in shades of gray.

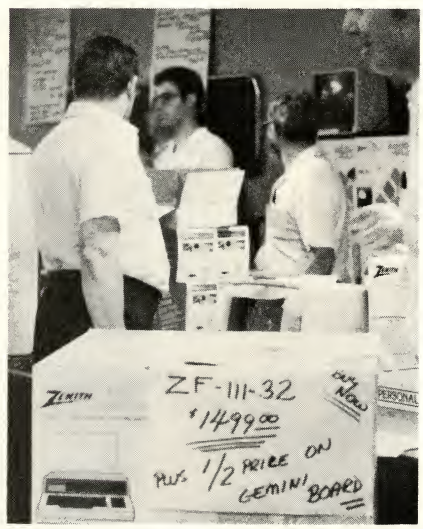

Photo by Charles Floto

Like the ZP150, the '171 has some built-in modules, such as a clock and calculator that appear on screen at the push of a special icon key. The built-in 300-baud modem can be upgraded to a 1200-baud one.

The other impressive machine is the Z200. Instead of just emulating the IBM PC AT, Zenith did them one better. The biggest improvement is in the Z200's speed—it's 30% faster, thanks to faster memory chips and other modifications. It would be even quicker if Zenith could have it run at 10 MHz rather than 6 MHz, but apparently the necessary Intel chips weren't available in large enough quantities yet. "Perhaps in the future," Foster said.

The '200 also has ten bus slots hidden within its sleek frame, as compared to the AT's eight. However, just as with the AT, several of these need to be filled with a video board and the like just to run the computer. Regardless of how you choose to fill up the expansion slots, the '200's 200-watt power supply should be more than capable of handling the load.

The Z200 has also been compared to the AT in another way. Reportedly, the '200 is "105% AT compatible." In other words, it will run some IBM PC software that even the AT won't.

D is for Dilworth.

Robert Dilworth is Zenith Data Systems' new president. Zenith hired him away from Morrow Designs Inc., whose Pivot laptop computer provided the design for Zenith's '171. Dilworth was both entertaining and informative in his role as the keynote speaker at Saturday night's banquet.

Dilworth started off by answering the three questions that he claimed every reporter asks him: Why did he come to Zenith? Where is ZDS going? How is ZDS going to respond to the Japanese?

Morrow's size frustrated him, Dilworth said, because it was obvious they couldn't become a major player in the computer market. Zenith, however, is ideally situated to become one of those major players, and he wanted to participate.

Dilworth did not give any concrete plans for ZDS's future products, but he did share what he envisioned for the microcomputer market as a whole. He foresees a move towards flat-screen displays, denser RAM chips, and optical-disk storage. The increased memory capacity of these machines will fuel the move to more user-friendly machines. "So far, computers have been aimed at people with at least a little technical bent. The next group we'll have to sell to will be less tolerant."

Dilworth also speculated on what people would do with all the increased memory they're going to have—500 megabytes of disk storage will be common. It will be especially useful if software evolves to drive hardware development to 32-bit operation—as programs like Lotus 1-2-3 did with 16-bit paths.

The amount of space that electronic components take up will decrease, he stated—not a surprising prediction. But, he added, "We're not far from basically putting the logic on a flexible board, rolling it up, and tucking it somewhere that it will fit." The resulting smaller machine would take up less space on already crowded desktops and be a lot more portable.

He dismissed the threat of the Japanese. "The Japanese have trouble competing until the technology is stabilized and they can crank up their manufacturing machine." In a constantly evolving market like microcomputers, Dilworth feels the Japanese can be outmaneuvered. He implied that Zenith plans to do just

this.

In responding to questions, Dilworth showed a diplomat's flair, not really giving any concrete promises, but hinting at some changes in Zenith policy.

One of the first questions asked was the old favorite, "When will Zenith start advertising more?" Dilworth promised more advertising, although he qualified it by stating that "If we're going to advertise, we have to see that it's going to sell machines—rather than make people who have them feel good about them."

Dilworth also promised to continue the Heathkit tradition, although he expressed doubts over whether some of the new technology could be packaged for home kit building. He promised to get future products into Heath stores as fast as they showed up in other Zenith dealerships. He also said he would try to "remove the busy signal" from the technical help lines.

Photo by Jennie D. Allen

E stands for Education.

Apple has long been the biggest player in the elementary and high school educational markets, but the college market has remained relatively open. This is an important and well contested niche, for students who are exposed to a certain brand of micro during their college years are more likely to choose that brand to work with later on in their careers. Through arrangements with Clarkson University, Kansas State University, and various other institutions, Heath/Zenith has started to have a noticeable impact on the educational market for microcomputers.

I was hoping to hear more about Heath/Zenith's plans for the university market in the seminar on Heath's role in education. Instead, the seminar dealt with an even older connection between Heath and education—Heath's electronics courses.

Heathkits have been used for years in technical education, and many vocational schools have entire courses built up around the kits and educational manuals that Heath supplies. Traditionally, the school courses have covered electronic circuits, radios, and the like. However, the emphasis today is shifting more towards computers, robotics, and lasers. One good example of how Heath is at the forefront of this trend is the use of the HERO robot in robotics courses.

After giving a bit of background, Ron Johnson and Ed Crowley, the two Heath/Zenith engineers who presented the seminar, gave demonstrations of Heath's new computer-aided design (CAD) package. This package trains students to use the AutoCAD-86 drafting package commonly used in industry.

The easiest way to explain CAD programs is to think of them as drawing editors. Like text editors, they allow for easy plotting and replotting of your ideas or concepts. Also like editors, CAD software is finding more and more uses in industry as its power and ease of use improve.

Crowley went on to discuss some possibilities for future courses. Heath plans to have training courses in computer graphics, data communications, and artificial intelligence available in the near future. Taking a longer outlook, he predicted the courses will come to rely more and more on computer-assisted instruction and laser-disk videos for instruction.

However, Heath will still have a need for human beings, especially outside help in designing educational courses. Heath often has non-staff experts in the field help write educational courses on electronics topics, Johnson pointed out. In fact, the designer of the CAD program was in the audience on Saturday.

Gee, I wonder if any of IBM's software writers ever show up to mingle with the commoners?

F is for Food.

No reviewer worth his salt would ever let an opportunity to critique the creature comforts get by without comment (after sampling such creature comforts to the fullest, of course).

The rooms and service at the hotel were good, but what else would you expect at Hyatt's prices? The food was good, too, although my judgement may have been influenced by the appetite I worked up waiting in line at the Garden Terrace coffee shop for breakfast. In all honesty, though, the restaurant really did well handling scores of HUGgies all coming down to breakfast at the last possible moment—about 8:30. (The first seminar was at 9:00.)

According to some of *Sextant*'s other staffers, the Hyatt's other two restaurants, Ventana's and The Other Place, were also good. Ventana's is a revolving lounge at the top of the Hyatt. It should have been the place to be after Saturday night's banquet, but there weren't too many HUGgies there. Either they were too tired after a full day of seminars, or too poor after purchasing that new computer, to enjoy the lounge's wonderful view of the Holiday Inn across the road. (Besides, *Ghostbusters* was available on pay television in the rooms.)

G is for Gemini.

In case you somehow missed all the announcements, D.E.L. Professional Systems has introduced an IBM PC emulator board for the '100. The Gemini board has had more hype than any other product for an H/Z machine in recent memory. As if the full-page color ads in *Sextant* the past several months or all the rumors on the bulletin boards and in *Buss* weren't enough, D.E.L. had even more attention-getters at HUGCON.

The first thing I noticed when I walked into D.E.L.'s own private showroom was the young woman in the all-too-familiar Chaplinesque get-up, replete with the little black mustache and cane. A three-piece combo dressed for a wedding reception played not-so-softly in the background while customers could spin a big, glittery wheel of fortune for discounts worth up to $200. It looked as though one of those TV game shows had come to the Hyatt. They were even giving out free coasters, pins, mugs, and tee shirts. (Before you even ask, yes, I now own a tee shirt with "Compatible at last" emblazoned on the left breast.)

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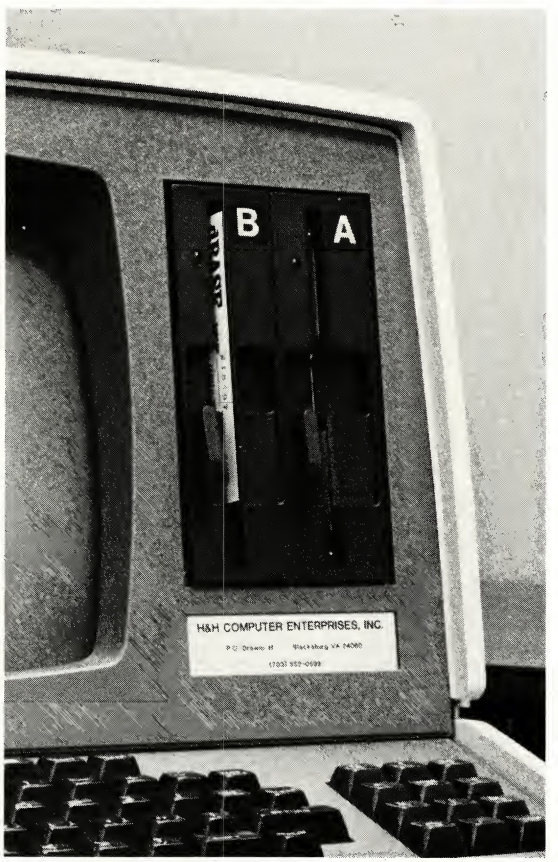

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it was announced that Zenith would be supporting two IBM-PC emulation products, D.E.L.'s Gemini board and the Easy PC board from U.C.I. Corporation. That, on top of all the hoopla, guaranteed a good-sized crowd at the Gemini seminar the next day. At the seminar, D.E.L.'s staff, including president Ed Dolejsi, were present to introduce their Gemini board and answer any questions.

The board plugs into your Z100's motherboard, adding its own 8088 microprocessor to the one you relocate from the motherboard. At bootup, you can choose between IBM and Z100 modes from the keyboard. The board can run at 8 MHz and supports the 8087 math coprocessor. A significant plus for the Gemini board is that one of its ROM chips contains the code Zenith wrote to let the Z150 run IBM software.

It will be easy to upgrade the Gemini as needed, since its compatibility is based on D.E.L.-written programs also stored in ROM. However, this approach makes Gemini slower than U.C.I.'s hardware-based Easy PC. (See **U** below.) There are also problems with copy-protection schemes which rely on reading an illegal track on the disk. The Z100's disk controller simply can't access such a track.

Gemini seemed to run just fine with all the IBM software I saw—including Microsoft's Flight Simulator and Borland International's SideKick. Of course, Gemini must remap the '100's keyboard to emulate the IBM version. This results in some awkward placement of keys. The '100's F0 key is used in place of the PC's ALT key, for instance. (Though awkward, this arrangement is probably no worse than IBM's original layout.)

It was announced at HUGCON that Gemini was scheduled to be available sometime in September. It will be sold and fully supported through Heath and Zenith stores at a cost of about $599. Gemini won't come with much documentation because, according to Dolejsi, "We don't want people to learn another trick. We want them to just plug it in and forget about it."

H is for HUGgies.

There were 1,344 HUGgies registered for HUGCON 4. That's about the same number as were at last year's HUGCON. There were HUGgies from all across the United States, as well as around the world, from places as far away as Fiji, Papua New Guinea, Okinawa, and Venezuela.

Not only was a diversity of countries represented, but a diversity of Heath/Zenith machines, as well. At Saturday night's banquet, Bob Ellerton, HUG manager, announced the attendance figures: 110 H8 owners, three H11 owners, 402 H89 and '90 owners, 627 H/Z100 owners, 260 H/Z150 owners, and even two HERO owners. Of course, that adds up to more than 1,344—but what Heath/Zenith owner was ever *completely* satisfied with just one computer?

I is for IBM.

Yes, unfortunately, the spectre of Big Blue seemed to hover over too much of HUGCON 4 for some diehard HUGgies' comfort. Some of the hottest news, in fact, was about the emulator boards coming from D.E.L. and U.C.I., which allow you to downgrade your '100 to a PC compatible. And, of course, all of Zenith's new computers are completely compatible.

L is for Language, as in programming.

Walt Bilofsky of The Software Toolworks reportedly packed them in with his "Introduction to C" seminar. In fact, it was so popular that he gave a repeat performance on Sunday in the time slot originally set aside for Pat Swayne's seminar on translating from 8-bit to 16-bit software.

(Pat's other two time slots were taken over by U.C.I and D.E.L. for their IBM emulator boards. Pat, by the way, was absent because of a new son. One speaker quipped that U.C.I. and D.E.L. will "be showing you their new babies while he's at home taking care of his.")

Bilofsky's seminar on the fastest-growing computer language was worthwhile both for experienced programmers moving up or over to C and for those who were just beginning, according to *Sextant*'s John Walker. Bilofsky showed how C takes a place between assembly language and higher-level languages like BASIC; then he went on to give an overview of the language itself. "It was really suited to a 'HUGgie outlook'," Walker said; "You didn't need a lot of experience to follow it, but you *had* to pay attention."

M stands for Microsoft.

We're all familiar with what those kids in Bellevue, Washington, did for BASIC, but they have hardly been inactive since. The Microsoft Disk Operating System (MS-DOS) has become a way of life for many computer owners, for instance, and they wrote Works, the operating system and package of application programs used in the ZP150. Now they have come out with MS-DOS version 3 and MS-Net to go with it. Zenith software engineers Dave Sandage and Bob Meinschein were there to talk about Microsoft's latest offerings.

MS-DOS 3 does not differ very much from MS-DOS 2 in the day-to-day details of operation. There are a few new system calls at the assembly-language level. You can also now specify a full path name to get a program from a subdirectory. Or by turning a long path name into a single drive letter, you can enable Z-DOS programs to support path names. And, wouldn't you know it, MS-DOS 3 provides the Z100 with better IBM compatibility.

The utilities, however, show the influence of one of the most sought-after capabilities in the market today, networking. A JOIN utility makes it possible to access a disk drive as though it were a subdirectory of a Winchester hard disk. Another utility,

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SHARE, enables several programs to share files at the same time. Also, there's a new TRIP utility that allows you to change file attributes such as read-only or hidden flags.

All of these new abilities of MS-DOS 3 are designed to work with MS-Net, a new networking system that will be available soon through Zenith.

O is for the Other HUGCONs.

Mentioned several times during the weekend, the Western Regional Heath Users' Group Conference, HUGCON West, is another big opportunity for HUGgies to get together. It is scheduled for November 15-17 at the Disneyland Hotel in Anaheim, California. The Pomona and Anaheim HUGs, led by Dr. Herb Friedman, are the organizers.

You may still have time to make arrangements to attend. (Write to Western Regional HUG Conference, 1555 North Orange Avenue, Pomona, CA 91767.)

By the time you read this, though, CHUGCON 85, the eastern regional conference, may already have been held. It's scheduled for November 2-3 at the Crystal City Hyatt Regency in Arlington, Virginia, just outside of Washington, D.C.

(Write to CHUGCON 85, P.O. Box 10515, Alexandria, VA 22310, or call 703/339-9857 for a recorded message.)

P is for the many Prizes given away.

It seemed as if you could hardly turn around in the exhibit hall without hearing Walt Gillespie calling out another round of prizewinners. The vendors contributed dozens of prizes, and HUG's display of prize-winning numbers was always crowded with HUGgies making sure they hadn't missed hearing their number being called.

The really big prizes were saved for Saturday night's banquet. Here, all the Heath/Zenith big shots got a chance to take the podium to give away a prize or two. In all, a total of four ZP150s, a HERO 1 robot, six gift certificates worth a total of $1,500, a fully loaded H100 kit, and a grand prize, a Z200 machine, were given away.

One of the highlights had to be Richard Galler of Raleigh, North Carolina, receiving his prize. I could have sworn he leaped over several chairs on his way to the podium. After waving his arms excitedly, he seemed on the verge of collapse when confronted with the tower of boxes his H100 came in. Since his H100 included 768K of RAM, 8-MHz operation, and a Winchester, I can see why.

The Z200 went to somebody whose name should be familiar to readers of *Sextant* #17—William Hall. Ironically enough, Hall had just ordered a Z200 which he was still awaiting. "I guess this means I cancel my order," he remarked as he shook Bob Dilworth's hand.

One of the ZP150s went to the father and son who had traveled the longest distance—all of 670 miles from Cumberland, Maryland.

After shouted suggestions from the audience, a father and daughter from New Mexico got a HERO 1 robot for being the furthest-traveled father-daughter combo.

Q stands for Question.

The perennial question, "What about HDOS 3?" was asked again this year, as always, and, as always, there is no firm answer on its availability. Bob Ellerton, HUG manager, claimed it was ready to go and he was just waiting for the disk from Bill Parrott, HDOS 3's beleaguered author. Apparently, however, it will be available only for the '8 and '89, and not for the '100 as was planned at one time.

R is for Resident utilities.

Call them resident, desktop, or pop-up utilities—whatever you want. They clear off your desk by loading it into your computer. A resident utility remains hidden in RAM until, with the touch of a key or two, you pop it up in front of the application program you're currently running. Jot a quick note, make a calculation, or check your calendar, and then exit back to the original program you were running without missing a beat. No doubt about it, resident utilities are one of the slickest—and most contested—areas of the software market today.

All five software companies that have resident utilities for the Z100 showed up at HUGCON. Advanced Software Technologies came with their Genie, Red E Products brought their Right Hand Man, Software Wizardry had Whiz, Sunflower Software was talking about the Informer, and Barry Watzman showed us his Perks. All five companies attracted a fair amount of attention, especially since they were offering special prices just for HUGCON.

S stands for *Sextant* magazine.

Six of *Sextant*'s hardworking staffers covered HUGCON this year, attending seminars and helping to work the booth. Our booth, by the way, was #45, just around the corner from HUG's information booth and Walt Gillespie's lectern and microphone. (At least we didn't miss any deals or prizes because of not hearing about them.)

Charles Floto, editor, publisher, and mentor, split his time between helping out at the booth and reminiscing about "Our First Eight Years" at his two seminars. Our technical editor, John Walker, spent time at the booth, attended a few seminars, and buttonholed authors—past and potential—about writing for *Sextant*. Sharon Conaway, assistant publisher, and Jennie Allen, managing editor, spent most of their time at the booth. One of the more difficult jobs fell to Bryan Rutberg, who helped staff the booth when he wasn't hurrying around trying to see all of our advertisers in his role as advertising sales assistant. Yours

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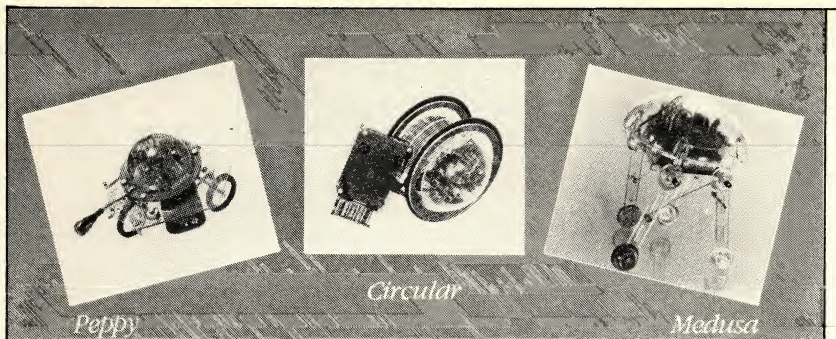

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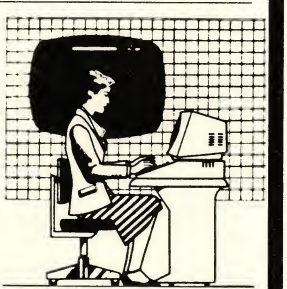

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truly, the lowly staff writer, spent most of his time attending seminars and just mingling.

T is Thanks to our many subscribers who stopped by to buy books or back issues, or just to chat.

U is for U.C.I.

U.C.I. Corporation (unlike their competitor, D.E.L. Professional Systems) did not have a three-piece combo playing in the background. Nor did they have their own private showroom. In fact, they have not even advertised their new emulator board. Bypassing all the hoopla has probably saved them loads, but it has given the Easy PC zero name recognition. That fact, and the extra $100 on the price tag, leads me to wonder how they will fare competing with Gemini.

U.C.I. has taken a hardware approach to IBM compatibility, adding three boards to mimic the IBM's motherboard, disk controller, and video board. This means that Easy PC will run faster than Gemini (at the expense of one of the S-100 expansion slots). Theoretically, it should also run more IBM software, since it replaces the hardware rather than bypassing it with some fancy programming. Surprisingly, though, some HUGgies reported that some of their really exotic communications and graphics software ran better with the Gemini board.

The Easy PC board relies on a software switch to choose between IBM PC and Z100 modes. It also supports 8-MHz operation; and unlike Gemini, it comes with a speaker assembly—so you can have audio as well as video.

Future updates for the Easy PC will be more difficult to create than those for Gemini. After all, it's much easier to reprogram some firmware than to replace chips and circuitry. Especially when you're dealing with a six-layer circuit board.

Easy PC is not as far along in development as Gemini. Although it too will be sold and supported by Heath/Zenith, it's been scheduled to take an extra month and an extra $100 to turn your 'Z100 into an IBM think-alike.

V is for Vendors, and there were a lot of them.

Over 50 vendors had booths in the exhibit hall. It was open throughout most of the conference, beginning at 2 p.m. on Friday and closing at 2 p.m. Sunday. New products were introduced, old ones explained, and, oh, the deals. Almost every vendor had a few specials just for HUGCON, and none of them wanted to go home with any extra merchandise.

I've seen a lot of going-out-of-business sales, but never a "going into business sale." The smiling face beneath the large banner belonged to Greg Chandler, former Heath/Zenith software guru who has set up shop on his own. Enthusiastic Software is starting out with just a few utilities; but as they say, it's the attitude that counts.

The resident utilities mentioned earlier were not the only hot software items at HUGCON. Graphics was also big news. SigmaSoft's graphics board and software for the '89 (reviewed in *Sextant* #18 by Kenneth A. Patrick) looked good. The package will make you think twice or maybe even three times about trading in your ol' '89 just to get the graphics available on a '100.

Other vendors who showed graphics enhancements were New Orleans General Data Services (proudly displaying HUG's "vendor of the year" plaque), Redwood Development (with a new computer-aided design program), and Technical Micro Systems, Inc. (TMSI).

The folks at TMSI were also busy giving out stickers supporting the '8 and '89, which proved popular with many HUGgies. Our technical editor, for example, sported an "I love my H8" sticker the whole three days of HUGCON.

The only sticker that may have beat TMSI's in popularity was the one with the red circle/slash of traffic sign and *Ghostbusters* fame, overlying an IBM logo. Those went so fast I didn't find out until later who had been handing them out. (Joe Katz of Columbia, South Carolina, turned out to be the wit behind it.)

Another staunch '8 and '89 supporter like TMSI, Controlled Data Recording Systems (CDR), showed off their wares in another area currently attracting a lot of attention, memory upgrades. CDR was displaying, among other things, their Super RAM 89 package, which gives '89 owners a full megabyte of RAM.

Hard disks were also a bargain as they continue to plummet in price. Floppy Disk Services, for example, offered an internal 10-megabyte version for IBM compatibles for only $550. They even offered internal hard disks for the '89, starting at $895.

There were many other deals and dealers far too numerous to mention in an article of any reasonable length. To coin a phrase, "I guess you had to be there."

Z is for Zenith to the rescue.

As the weekend wound to a close, most HUGgies were happily drained of both cash and energy, having treated themselves to Christmas during the dog days of August. However, some were rather worried about how to explain things to their long-suffering spouses.

Don't worry. Zenith has thought of everything. As he started his speech at the banquet on Saturday, ZDS president Bob Dilworth commented that he had been riding up in one of the elevators with a worried HUGgie who was wondering how he was going to tell his wife that he had just dropped $2,000 on a new computer. Dilworth smiled from the podium, "If it would help, I could write a note." △

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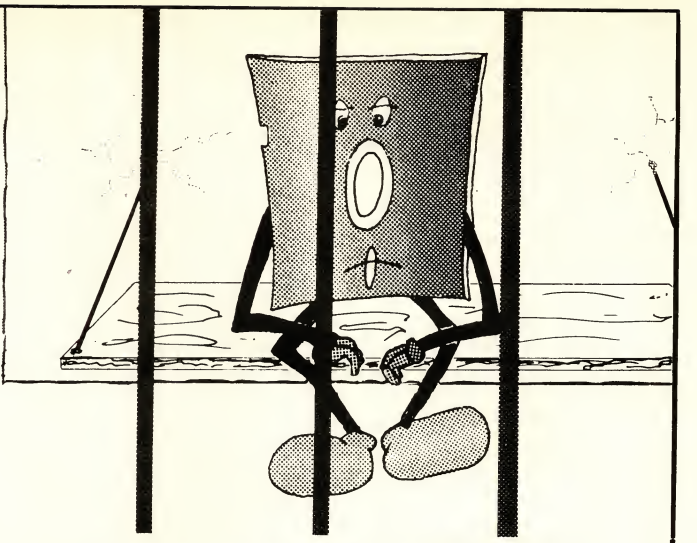

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RAM Drives for the '100

These three products can speed up the Z100's operations by cutting down on disk accesses.

D. C. Shoemaker

What good is a Z100 computer with 192 kilobytes (or 256K or more) of memory when most of today's applications software requires only a fraction of that?

One excellent answer is to use some of that memory as a RAM disk to speed up your computer work. This brief article will take a look at what a RAM disk is, how it works, and what it can do for you.

First, what's a RAM disk?

Any time you can put a program or data into a segment of your computer's memory and recall it at will, you're simulating a floppy-disk drive. You've got a RAM disk.

Another way to put the idea is to say that whenever you call a program or data in from a floppy disk, you're making that disk behave as if it were part of the computer's on-line memory.

(Some people emphasize the comparability between memory and disk space by the use of the word "virtual." A RAM drive is frequently called a "virtual drive." "Virtual memory" uses the computer's disk space as if it were a part of the main memory. We do this when we run a large application program in memory and temporarily store part of the program or data files on disk, swapping parts back and forth as needed.)

A computer's on-line memory used to be called "core memory." This was because the memory was constructed from tiny rings of ferromagnetic material after an invention by Jay Forrester in the early 1950's. These rings were interlaced with wires carrying the power to magnetize each ring with one polarity or the other, and other wires to sense which ring had which polarity.

The computer could "look" at any ring in any order; so, this type of memory became known as random-access memory, or RAM. That distinguished it from the sequential memory of the time, usually tubes of mercury through which compression waves could be made to travel.

Our more familiar silicon RAM chips are a tremendous improvement over magnetic core memory, but the fundamentals of use are the same. As magnetic core memory began to be replaced by other forms, the term "main memory" came into use. That's the term I'll use to refer to the part of the computer's memory that stores information only while the power's on.

The computer can examine any memory location at random. This allows the computer great speed, and results in great computing power. RAM is at least an order of magnitude (ten times) faster than a disk drive. So, disks are used to store programs and data; then the disk files are accessed for use in main memory when it's necessary to execute the program or process the data.

When a program must be called into memory repeatedly, however, a lot of time is lost while the computer reads the program from the disk and copies it into RAM. Hard disks speed up the process, as well as providing increased storage capacity. But it's still a great deal slower to read a program in from a hard disk than it is to execute it.

Enter the RAM disk.

If it were possible to read a program into RAM once, then keep it there to be accessed directly from memory whenever we needed it, that would clearly speed up the processing considerably. That's precisely what a RAM disk allows us to do.

A RAM disk is nothing more than a program that sets aside a block of memory in the computer's main memory and copies into it a program or data from a disk drive.

For instance, if a RAM-disk program blocks off 64K of memory for you to use as an electronic disk, that means that the 64K block has been taken away from the memory-management part of the operating system. In other words, the operating system can no longer use that RAM for anything. It disappears from its "view." Your program can be copied into that memory space, and it will stay there, unaffected by anything the operating system does.

Once the program or data is stored in the RAM disk, you can access it just as you would from a floppy or hard disk. For example, if your RAM disk is named drive G:, you could type DIR G: and receive a directory of the contents of that "disk." It should work just as if it were a physically real disk, not just an electronic fabrication. If you had a copy of ED.COM stored on drive G:, the results of your DIR command would show ED.COM present for duty.

Of course, there's a catch to almost everything, and RAM disks are no exception. When you lose power, you lose the electronic disk. Everything goes away as if it were never there.

There are ways to get around that flaw, however. A moment's thought probably already suggested that the thing to do is copy the program you want to use into the RAM disk, but store the *output* of that program onto a floppy disk.

For instance, WordStar is notoriously slow when operating from a floppy disk, because of the overlay files that it constantly has to call in to perform various tasks. If WordStar and all its overlays were on the RAM disk, operation would be a lot faster. The text files you will create, though, should be written to the floppy disk. That way, if you lose power, or some other disaster downs the computer, the file (or most of it) will be intact. WordStar will go away, but you can easily reload that at the next boot-up.

Once you grasp the basics, you can see how easy it would be to automate much of your work by creating a batch file under CP/M or under the Zenith Disk Operating System (Z-DOS). The batch file (a .SUB file under CP/M, a .BAT file under Z-DOS) would be executed at boot-up. It would contain the appropriate operating-system commands to activate the RAM disk, copy the programs into it, change the default drive to the RAM disk, start the program, and automatically return you to the A: disk when you exited the program.

Listing 1 is a Z-DOS AUTOEXEC.BAT file that does just that.

There are three products available to H/Z100 users that will do what we've been talking about. Two are add-on programs that you can buy from independent vendors (and probably some Heath/Zenith stores); the third comes with the operating system itself. One is for CP/M-85, one for Z-DOS, and one for version 2 of the Microsoft Disk Operating System.

D.C. Shoemaker is on active duty in the Army in Europe. (For the record: opinions expressed by U.S. Government employees are not necessarily those of their employer.)

There are other RAM disks on the market; some come with memory-expansion boards, and others can be bought separately. The ones I'm going to describe are ones I've had personal experience with. I don't doubt the others are good, but I haven't seen them.

RAMDRIVE

First, for Z-DOS version 1 users, there's an excellent program written by Shing Wong, of Wong's Advanced Technologies, and marketed by Omega Systems of Baton Rouge, Louisiana.

This software requires an H/Z110 or '120 with 128K and Z-DOS version 1. It will not work on MS-DOS version 2.

RAMDRIVE is a stand-alone program (a command, or .COM, file) that can be run when you need it. It allows you to specify the size of the RAM disk to be created; so you can take advantage of whatever amount of memory you may have available. For instance, you can type RAMDRIVE 128 and create an electronic disk with a capacity of 128K.

The program creates a drive called G: which can give you a directory just as any other disk drive would.

The RAM disk remains present until you re-boot. You cannot get rid of it any other way. I'm told there is a more recent version that has a "remove" capability, but I haven't seen it.

The program comes with full installation instructions, quite simple actually, and a benchmark program called DTEST that demonstrates just how fast a RAM disk is.

All in all, a very nicely done program that really makes the Z100 perform.

(Wong also has a version of RAMDRIVE available for MS-DOS. This operates the same way as the earlier version, but allows the RAM drive to be removed by using the /r command. This can be useful if you don't want to reboot, but you want to resize the RAM drive or you want that RAM back for something else.)

```
AUTOEXEC commands          Explanation of the commands

CLS                        Clear the H120 screen
RAMDRIVE 92                Call RAMDRIVE and request 92 K of memory
COPY WS.COM G:             Copy WordStar to the RAM disk (G:)
COPY WSOVLY1.OVR G:        Copy the first overlay to G:
COPY WSMSGS.OVR G:         Copy the second overlay to G:
KEYWS                      Call a WordStar function key mapping program
G:                         Set the default drive to the RAM disk
WS                         Call WordStar
A:                         Return to drive A: when editing is complete
UNMAP                      Turn off the key mapping program
```

Listing 1. An example of an AUTOEXEC.BAT file that installs the Z-DOS RAMDRIVE and loads WordStar into that part of memory reserved by the program. An explanation of each command is given on the right.

RAMDRIVE/85

Next is a product for use with CP/M-85. Called RAMDRIVE/85, it's produced by J. J. Thompson, of Kenmore, New York. (As the author of a number of file-transfer utilities to go between CP/M and the Heath Disk Operating System and between CP/M and Z-DOS, he's no stranger to long-time Heath computer users.)

RAMDRIVE/85 is a bit different in that it modifies CP/M-85's basic input/output system (BIOS). This method provides you with the RAM disk every time you boot a suitably configured disk.

That fact suggests that you might not want to configure all your working disks to include RAMDRIVE/85. On the other hand, since you can't really use all your extra memory under CP/M, it may not make any difference.

RAMDRIVE/85 requires the user to duplicate the distribution disk, copy the RAMDRIVE/85 files onto the new disk, and execute a SUBMIT file provided to do the dirty work. Executing the SUBMIT file will replace the original BIOS with one suitably modified to provide the RAM disk.

With RAMDRIVE/85, you're limited to 64K blocks of RAM. This shouldn't be much of a drawback, because that's the largest main memory space you can have under CP/M-85, so any of your programs will fit. You can have up to ten separate 64K banks of RAM, however, if your computer's memory will permit. These banks begin on the 128K boundary (the third bank of 64K) of your main memory. (Recall that CP/M-85 uses a little of the second 64K bank.) You can therefore use up to 768K main memory. However you set up the RAM drive, it will become drive M: in your system. When you boot, you'll get a message confirming that the RAM disk is present as drive M:.

RAMDRIVE/85 differs from the other two products discussed here in its "durability." No matter what you do, so long as the computer doesn't use the RAM disk space and you don't switch off the power, the RAM disk remains intact. You can re-boot or even change operating systems to run Z-DOS. Z-DOS programs, of course, don't operate under CP/M's 64K limit. They may be large enough to write over the space occupied by RAMDRIVE/85.

But smaller Z-DOS programs should pose no threat. And a CTRL-RESET under CP/M will not touch the RAM disk.

When you re-boot from CP/M-85, you will be asked if you want to over-write (re-initialize) the RAM disk. If you elect not to, the original contents of the RAM disk are still present. A nice touch.

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Resident Speller alone: 192K
WatchWord with Speller: 300K

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MDISK.DVD

Well, we have a RAM disk for CP/M. And there's one for Z-DOS—which was Heath/Zenith's version of MS-DOS version 1. Finally, for those of you who have upgraded to MS-DOS Version 2 on the H/Z110 or '120 (as well as for you H/Z151 and '161 users), there's a RAM disk feature built into MS-DOS that you may have overlooked.

Check the MS-DOS manual under Chapter 9, "System Component Features," pages 9.21 and 9.22. There, you'll find a section that discusses the MDISK.DVD memory-disk device driver. This driver allows you to create one or more 64K segments in main memory that will each act as an electronic disk.

As with Wong's RAMDRIVE, anything stored in these segments disappears when you re-boot or when you turn the computer off.

Like the others, MDISK can be installed by means of a batch file; but it can also be created, and more easily, by adding the appropriate statement to the CONFIG.SYS file that MS-DOS looks for at boot-up. CONFIG.SYS is an ordinary ASCII file of commands—rather like a PROLOGUE.SYS file under HDOS. (That's not surprising since the redoubtable Gordon Letwin, the creator of HDOS, now works on MS-DOS.)

The command to create MDISKs in the CONFIG.SYS file is DEVICE=MDISK.DVD—where MDISK.DVD must be available to the current directory. If it isn't, the command should be DEVICE=\DEV\MDISK.DVD where \DEV is assumed to be a subdirectory called \DEV where device drivers are filed.

The MDISK drive is called by typing the command:

DEVICE = MDISK.DVD

where DEVICE will be a single-letter drive name followed by a colon.

You can repeat the process for more memory segments. The first will be called device I:, the next will be J:, and so on. As with RAMDRIVE, once installed the RAM disks cannot be removed except by re-booting.

If you are contemplating buying MS-DOS version 2, you might note that there are a lot of features like this, built into the system. Of course, there's always a cost, and in this case it's the slower speed of version 2 as compared to version 1.

The price of MDISK.DVD is right, however; it's free with the operating system.

Do you need one?

Do you need a RAM disk?

Chances are that you would benefit from using one if you use any program on a repetitive basis.

For instance, I spend a lot of time typing assembly-language source code, assembling the source code, and LOADing the resulting hex file just so I can find the first bug. Then I re-edit the source code, re-assemble, re-LOAD and so on.

With the text editor, ASM, and LOAD in the RAM disk, this process is greatly speeded up. In fact, you can even type in your source code and store it on RAM disk. (That's another way to speed the process—so long as you don't forget that it's not stored in some more permanent form.)

Similarly, WordStar, with its overlays, runs a great deal faster from the RAM disk.

On balance, the two commercial programs are worthwhile and highly recommended. As for MDISK, that depends on whether you want to buy MS-DOS version 2.

Ordering Information

RAMDRIVE (Z-DOS), $49.95.
Omega Systems, Inc.
11814 Coursey Boulevard
Suite 510
Baton Rouge, LA 70816
504/923-0388

RAMDRIVE/85 (CP/M-85), $39.95 plus $2 postage.
J. J. Thompson
281 Warren Avenue
Kenmore, NY 14217
716/873-0380 after 5 p.m.

MS-DOS Version 2, including MDISK.DVD, $150.
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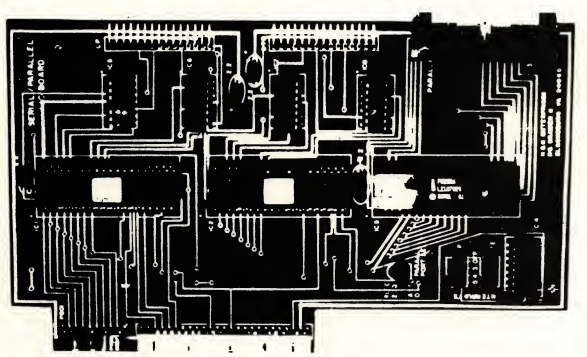

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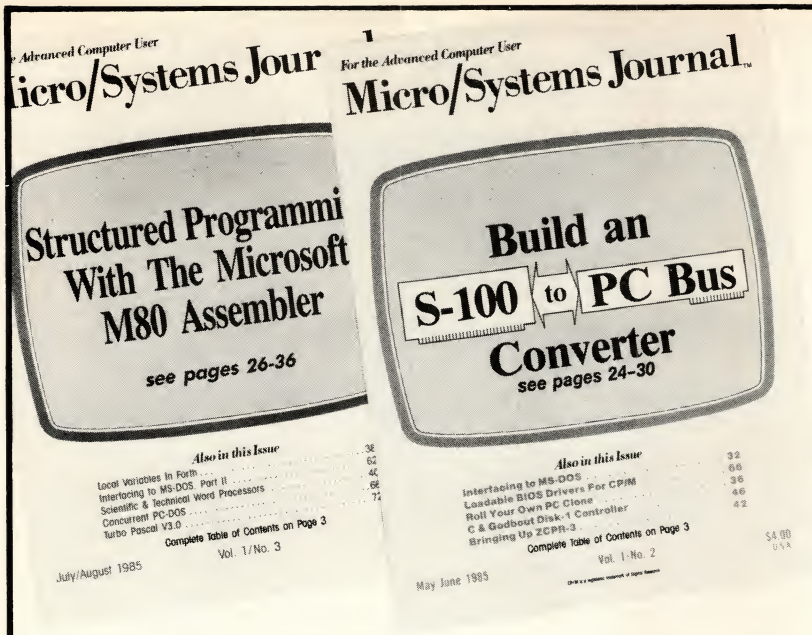

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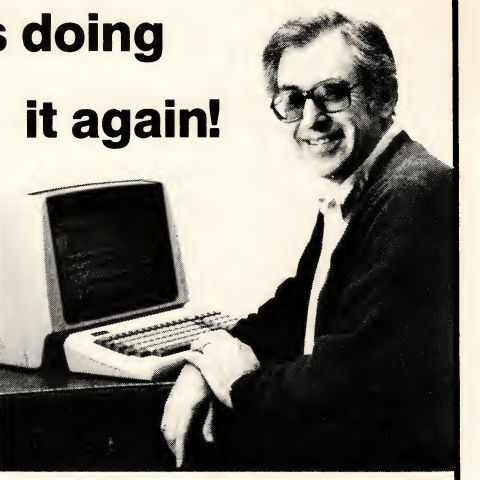

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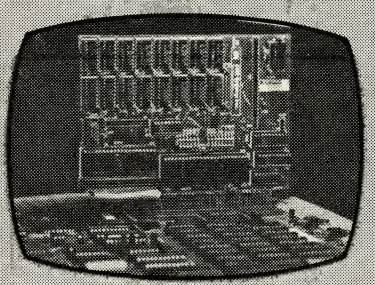

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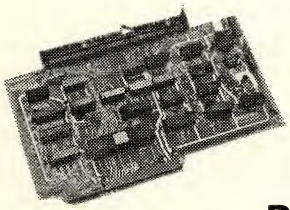

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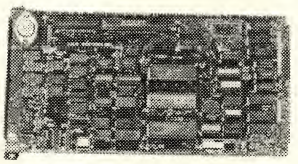

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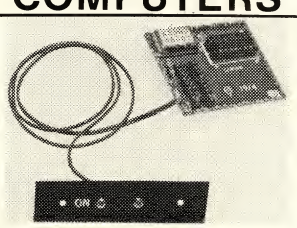

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Circle #108 on Reader Service Card

Make Your '89 Speak Greek

The '19's and '89's block graphics are sufficient to draw an alternate alphabet. This routine was designed to be incorporated into a flash-card drill program.

Ray Albrektson

I loved integrating my computer into life as a seminary student. Word-processing programs were made in heaven for the struggling theological student. But I hit a real snag when I took my first Greek course.

How in the world could I get my H89 to display Greek characters?

There was always the hardware route. The normal character set and the alternate block-graphics character set are both controlled by the H/Z89's character generator, a read-only memory (ROM) chip. I could have burned a programmable ROM with a PROM programmer. Then I could display bona-fide Greek characters as an alternate character set instead of the block-graphics in the '89's character ROM.

That solution would probably have been expensive. Besides, handling ROMs has made me nervous ever since the time I broke six pins off a $50 monitor ROM trying to get it into its socket!

So, I decided to try a software-based method.

My immediate goal was just to incorporate a Greek display into a vocabulary drill program, a simple flash-card program. I wasn't concerned about sending it to a printer. And since it was just for drill, I could dispense with the uppercase Greek letters. (See Figure 1 for the Greek alphabet.)

The raw material at hand was the block graphics built into the '89. In the '89's graphics mode, the lowercase letters (and four of the less used characters: {, }, ~, and |) become diagonal, angular, and various other shapes. (If you want to examine the graphics characters on screen, just go OFF LINE, type ESC F, and type away. ESC G will bring you out of graphics mode.)

Could a passable character set be made using the graphics characters? I whipped out a pad of video layout sheets for the '89 and gave it my best shot.

What will they look like?

I soon discovered that I could build beautifully elaborate Greek letters from the '89 graphics. But it took too many of the graphics characters. The Greek letters were too big to fit more than a few on the screen at one time! The smaller I made them, the more crudely they resembled the real thing.

A little experimentation using the block-graphics characters showed that I would need a grid of four graphics characters by five to make the smallest recognizable set of characters. My hand-

Ray Albrektson lives and computes in the Philippines, where he's a faculty member of the International School of Theology–Asia.

Name	Capitals	Small Letters
Alpha	A	α
Beta	B	β
Gamma	Γ	γ
Delta	Δ	δ
Epsilon	E	ε
Zeta	Z	ζ
Eta	H	η
Theta	Θ	θ
Iota	I	ι
Kappa	K	κ
Lambda	Λ	λ
Mu	M	μ
Nu	N	ν
Xi	Ξ	ξ
Omicron	O	ο
Pi	Π	π
Rho	P	ρ
Sigma	Σ	σ ς
Tau	T	τ
Upsilon	ϒ	υ
Phi	Φ	φ
Chi	X	χ
Psi	Ψ	ψ
Omega	Ω	ω

Figure 1. The Greek alphabet.

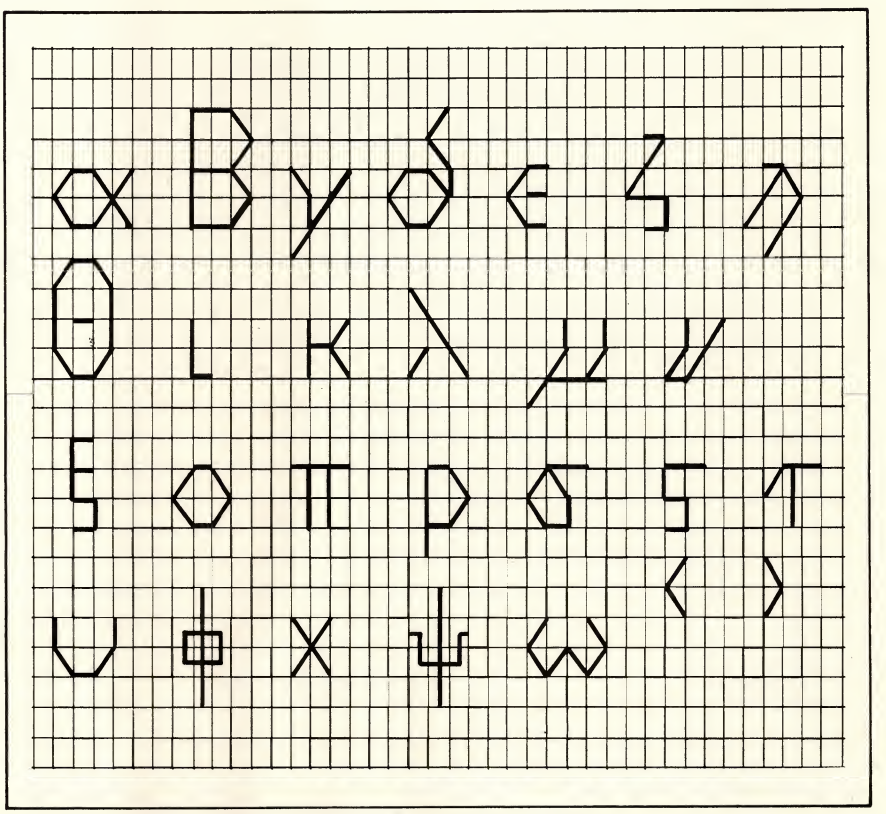

Figure 2. The Greek alphabet for display on an H/Z19 or H/Z89.

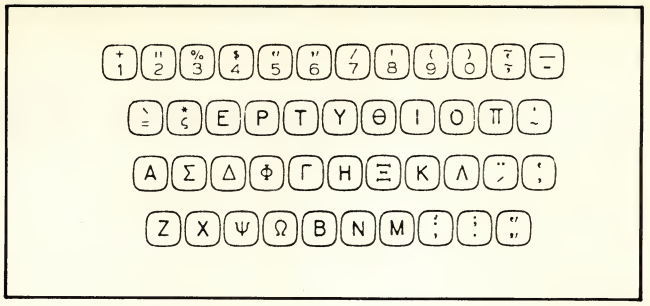

Figure 3. The keyboard layout for the IBM Greek character set. This is the arrangement incorporated in Listing 1.

```
10 'SUBROUTINE TO DISPLAY A$ IN GREEK CHARACTERS
20 '            BY RAY ALBREKTSON
30 LINE INPUT A$:GOSUB 40:GOTO 30
40 'ENTERS WITH A$ CONTAINING ASCII EQUIVALENT OF GREEK TO DISPLAY
50 'USES A$, E$, G$, N$, CL$, U$, D$, L$, R$, P, N, F
60 IF F = 1 THEN GOTO 260                'SKIP LET STATEMENTS
70 E$ = CHR$(27)                         'ESCAPE
80 G$ = E$ + CHR$(70)                    'ENTER GRAPHICS MODE
90 N$ = E$ + CHR$(71)                    'ENTER NORMAL MODE
100 CL$ = E$ + "E" :PRINT CL$            'CLEAR SCREEN
110 U$ = E$ + CHR$(65)                   'CURSOR UP
120 D$ = E$ + CHR$(66)                   'CURSOR DOWN
130 L$ = E$ + CHR$(68)                   'BACKSPACE CURSOR
140 R$ = E$ + CHR$(67)                   'FORWARDSPACE CURSOR
150 L1$ = L$ + D$                        'LEFT ONE AND DOWN
160 L2$ = L1$ + L$                       'LEFT TWO AND DOWN
170 L3$ = L2$ + L$                       'LEFT THREE AND DOWN
180 L4$ = L3$ + L$                       'LEFT FOUR AND DOWN
190 U1$ = U$ + R$                        'UP ONE AND RIGHT ONE
200 U2$ = U$ + U$ + R$                   'UP TWO AND RIGHT ONE
210 U3$ = U$ + U$ + U$ + R$              'UP THREE AND RIGHT ONE
220 U4$ = U$ + U$ + U$ + U$ + R$         'UP FOUR AND RIGHT ONE
230 U5$ = U$ + U$ + U$ + U$ + U$ + R$    'UP FIVE AND RIGHT ONE
240 F = 1                                'SET FLAG TO SKIP LET STATEMENTS
250 '
260 PRINT G$                             'GO TO GRAPHIC MODE
270 FOR P = 1 TO LEN(A$)                 'PICK APART G$ LETTER BY LETTER
280    IF A$ = "" THEN PRINT N$:RETURN   'IF NUL STRING, ABORT
290    N = ASC(MID$(A$,P,1))-96          'CONVERT ASCII TO EQUIVALENT LINE NUM
300    IF N = -64 THEN PRINT R$;R$;R$;R$;:GOTO 1160                    'SPACE
310    IF N > 20 THEN N = N - 20: GOTO 380
320    IF N > 10 THEN N = N - 10: GOTO 360
330    IF N < 1 THEN GOTO 1160 ELSE IF N > 30 THEN GOTO 1160
340      ON N GOTO 1097,1098,1099,1100,1101,1102,1103,1104,1105,1106
350         GOTO 1160
360      ON N GOTO 1107,1108,1109,1110,1111,1112,1113,1114,1115,1116
370         GOTO 1160
380      ON N GOTO 1117,1118,1119,1120,1121,1122,1123,1124,1125,1130
390 '
400 '
1097 PRINT D$;D$;"xzyx";L4$;"y{xy";U3$;:GOTO 1160                        'ALPHA
1098 PRINT"}zzy";L4$;"}  x";L4$;"}zzy";L4$;"}{{x";U3$;:GOTO 1160         'BETA
1099 PRINT D$; " `  ";L4$;"c'f ";L4$;"ebd ";L4$;" `  ";U4$;:GOTO 1160   'PSI
1100 PRINT "  x ";L4$;"  y ";L4$;"xzy|";L4$;"y{x ";U3$;:GOTO 1160        'DELTA
1101 PRINT D$;" { ";L3$;"x{ ";L3$;"y{ ";U3$;:GOTO 1160                  'EPSILON
1102 PRINT D$;" ` ";L3$;"fbc";L3$;"ebd";L3$;" ` ";U4$;:GOTO 1160        'PHI
1103 PRINT D$;D$;"y x ";L4$;"}x  ";L4$;"x   ";U4$;L$;:GOTO 1160         'GAMMA
1104 PRINT D$;" {  ";L4$;" xy ";L4$;"x x ";L4$;" x  ";U4$;:GOTO 1160    'ETA
1105 PRINT D$;D$;"}  ";L3$;"}{ ";U3$;:GOTO 1160                          'IOTA
1106 PRINT D$;"}z ";L3$;"}z ";L3$;" z|";L3$;" z ";U4$;:GOTO 1160         'XI
1107 PRINT D$;D$;"}{x";L3$;"} y";U3$;:GOTO 1160                          'KAPPA
1108 PRINT D$;"y  ";L3$;" y ";L3$;"x y";U3$;:GOTO 1160                   'LAMBDA
1109 PRINT L$;D$;D$;" } ";L4$;" x x";L4$;"xzzz";U4$;:GOTO 1160           'MU
1110 PRINT D$;D$;" |x";L3$;"xx ";L3$;"z ";U4$;:GOTO 1160                 'NU
1111 PRINT D$;" {  ";L4$;"x y ";L4$;"y{x ";U3$;:GOTO 1160                'OMICRON
1112 PRINT D$;"{{{ ";L4$;"}}  ";L4$;"}} ";U3$;:GOTO 1160                 'PI
1113 GOTO 1160 'Q IS NOT IMPLEMENTED!
1114 PRINT D$;" { ";L3$;"} y";L3$;"}{x";L3$;"}  ";U4$;:GOTO 1160         'RHO
1115 IF MID$(A$,P+1,1)=" "THEN GOTO 1119 ELSE PRINT D$;" {{";L3$;"xy ";@
     L3$;"y{|";U3$;:GOTO 1160                                            'SIGMA
1116 PRINT D$;" {{";L3$;"x` ";L3$;" ` ";U3$;:GOTO 1160                   'TAU
1117 PRINT "xzy ";L4$;"| } ";L4$;"|z} ";L4$;"y{x ";U3$;:GOTO 1160        'THETA
1118 PRINT D$;D$;"x  y";L4$;"yxyx";U3$;:GOTO 1160                        'OMEGA
1119 PRINT D$;" {{";L3$;"}  ";L3$;" z|";L3$;" z ";U4$;:GOTO 1160         'SIGMA
1120 PRINT D$;D$;"yx ";L3$;"xy ";U3$;:GOTO 1160                          'CHI
1121 PRINT D$;D$;"| }";L3$;"y{x";U3$;:GOTO 1160                          'UPSILON
1122 PRINT " { ";L3$;" x ";L3$;"x  ";L3$;"zz|";L3$;" z ";U4$;@
      :GOTO 1160                                                         'ZETA
1123 PRINT L$;L$;L$;L$;L$;"x";L1$;"y";R$;R$;R$;U1$;:GOTO 1160            'ROUGH
1124 GOTO 1160
1125 PRINT L$;L$;L$;L$;L$;"y";L1$;"x";R$;R$;R$;U1$;:GOTO 1160            'SMOOTH
1130 '
1140 '
1150 '
1160 NEXT P
1170 PRINT N$                            'BACK TO NORMAL CHARACTERS
1180 RETURN
```

Listing 1. This HDOS MBASIC routine displays Greek characters from input according to the keyboard layout shown in Figure 3, or from a file created the same way. Long lines are shown here extended to more than one physical line by using the at-sign (@). They can be input as one line if your editor can create lines longer than the width of the screen.

iwork is evident in Figure 2. (If you think you could do better, be my guest!)

Greek is one of those languages with plenty of funny little accents—diacritical marks, they're called. I used the "stonewall" approach for dealing with them in my program. In other words, I ignored them. Fortunately, they affect the meaning of a word only once in a great while, and I decided to take my chances.

Two marks I just had to include, however, were the "breathing marks." A breathing mark indicates whether an initial vowel has an "h" sound or not. They look kind of like this: ' and '. I decided to represent them by the left and right curly brackets { and }.

Where will they go?

Now I had to consider how I would correlate the keys which are used for our familiar Roman alphabet with the Greek symbols to be displayed. Should I make the "W" represent the Greek letter omega (ω) because of the physical resemblance in lowercase?

Another problem: Greek has two separate letters for the sound of "O." Omicron is the letter used for a short "O" and omega is used for long "O." Which should I assign to the only "O" on the keyboard?

My terminally cluttered desk yielded the answer. I found a catalogue of IBM Selectric type-balls showing the "standard" keyboard layout for classical Greek. (See Figure 3.)

How to do it?

Using my program just as it is in Listing 1, you can input a word and the routine will translate it into Greek characters. (It's not intended to stand on its own, of course, as you'll see if you try it out. It gets confused after a couple of words.)

Incorporated into a flash-card program, the routine would receive its input from disk. You just have to make up the disk file using Figure 3 for reference. Type in the ordinary ASCII characters which are equivalent to the appropriate Greek characters. The flash-card program should take it from there.

My basic strategy was to have my subroutine accept a word or phrase in plain old ASCII characters. The subroutine, written for Microsoft BASIC under the Heath Disk Operating System (HDOS), would pick out each letter in turn and paint it on the screen using the Greek character set of Figure 2.

After the routine has painted a letter, the cursor needs to wind up in the proper place to begin the next character. This plan meant that the cursor would have to hop around the screen more than a frog break-dancing under a lawn-mower. Obviously, it would pay to develop a set of cursor-movement strings. Lines 70 through 230 of Listing

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B1: JSMITH .LTR 2K 16:30-24 Dec'84 11:59-10 Feb 16:30-24 Dec'84
B1: TEST1 .BAS 4K 09:34-22 Jan 16:27-30 Jan 09:35-22 Jan
B1: TEST2 .BAS 4K 11:55-01 Feb 11:55-01 Feb

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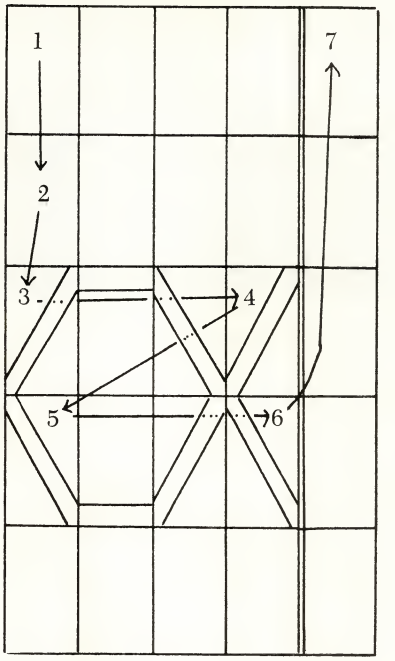
1 show how a set of shorthand commands were built up.

How painting a character works is shown in Figure 4. Each character fits into a space that is four characters wide and five lines high. Examine the sequence designed to draw the letter alpha, for example. (It's on line 1097, since the ASCII code for "a" is 97.)

The first (upper) two rows have nothing in them, since alpha is a short little character. For that reason, two "Down" strings (D$) are printed. The graphic symbols corresponding to "xzyx" in row three are printed next; these are followed by a string (L4$) that sends the cursor back four spaces and down one. This leaves it in a position to print the last line of symbols, the graphics equivalents of "y{yx".

After the last line is printed, it is important to put the cursor where the next character will begin. In this example, string U3$ will leave the cursor in the top-left block of the next character position, where the program will expect



1. The cursor starts here.
2. Printing D$ sends it here.
3. Another D$ puts it at the first cell where a symbol is to be printed.
4. Printing the graphics-character equivalents of "xzyx" leaves the cursor here.
5. L4$ gets the routine ready to print the last line, beginning at 5.
6. The last line is the graphics equivalent of "y{yx"; printing that leaves the cursor here.
7. U3$ is printed to put the cursor at the starting position for the next character.

Figure 4. The sequence by which Listing 1 paints the character alpha (α).

Drat!

Naturally, there were problems. For instance, the first few Greek letters would print fine, but I could not display a complete line without a stray line-feed messing up the appearance of the text. I realized that after 80 characters my '89 was interjecting its own line-feeds. This was easily fixed by setting the width to 255:

```
SET TT: WIDTH 255
```

This kept the '89 from ever putting in a gratuitous line-feed, and the Greek words really began to look nice!

The main problem, though, was in MBASIC itself.

The section of the subroutine that dissects the word letter by letter is in lines 270 to 380. I put all the Greek-letter-printing lines together in ascending order. Originally, I had hoped that the routine would receive a given letter ("a" for "alpha," say); it would use the letter's ASCII value (97 in the case of "a") in calculating the value of a variable V. A GOTO V would then jump to the appropriately numbered line responsible for printing an alpha.

Alas! To my horror I discovered that MBASIC doesn't allow this—it's called a "computed GOTO." I pondered the massive injustice of a dinky computer like a Timex/Sinclair that allowed computed GOTOs while my '89 was incapable of doing such a reasonable little job!

My next idea was to use an ON... GOTO... combination. I tried putting all thirty line numbers in one massive ON... GOTO... statement. The interpreter gagged and regurgitated an error statement.

Gritting my teeth, I broke the statement into three sets of ON... GOTO... commands (lines 300 to 380), and it finally worked!

And now?

The completed subroutine was speedily patched into a flash-card program. I was soon happily drilling myself on the vocabulary of the Greek New Testament.

My experiment should encourage others to try the same approach for other languages. I think the Cyrillic (Russian) and Hebrew alphabets could be done exactly the same way. Hebrew could even be made to print from right to left!

Some may ask, "Was it worth it?" Well, all I can say is (with all humility), I got an "A," didn't I? △

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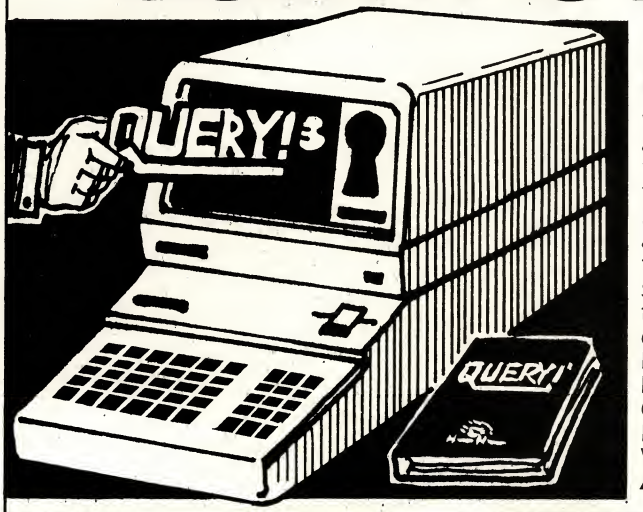

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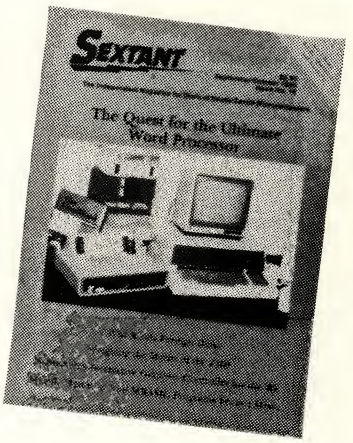

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HDOS Enhancements from T & E

T & E associates' HDOS utilities make disk and file management much easier.

Robert Page Carter

The Heath Disk Operating System (HDOS) has been my favorite ever since I built my H89 several years ago. And I am continually on the lookout for utilities that will make it even better.

Thus I was intrigued when T & E associates released their HDOS Enhancements #1 and #2—especially since I am very enthusiastic about their device driver for my H14 printer.

Enhancement #1 includes the following utilities:

DM.ABS Disk Manager; and

FM.ABS File Manager.

Enhancement #2 contains:

ET.DVD, a screen-to-printer processor;

GP.DVD, a general-purpose printer driver;

UNLOAD.ABS, a device-driver unloader;

SWAP.ABS, a utility to swap device drivers in memory; and

SET.MOD, which modifies HDOS's SET utility to recognize files with an .OVL extension.

DM.ABS

DM.ABS is very similar to WASH and SWEEP, the public domain disk-management utilities available for use under CP/M.

Under DM, the possible actions you can take on files are VIEW, COPY, RENAME, DELETE, PRINT, and REMOVE FLAGS. And you can CATALOG and MOUNT and DISMOUNT disks.

As soon as it is executed, DM will display the directory of SY0:'s files on your screen in a brief, five-column format. The files are arranged horizontally in alphabetical order.

This program makes clever use of reverse video to designate the flags set on each file. For instance, if the system (S) flag is set on a file with an .ABS extension, then the S will be displayed in reverse video. If the write-protect (W) flag is set, the A is in reverse video.

A blinking "<" cursor is your marker. You use the arrow keys on the numeric keypad to move it to the file you want to take action on.

The only disconcerting thing about this arrow movement is that when you keep moving down past the end of a column, you are not sure which column the marker will continue on to. Logically, to me, it should move to the top of the next column; but this is not always the case. It seems to depend on the number of files displayed.

The actions you can take on each file are displayed in reverse video across the 25th line, and mark the various function keys. When the "<" marker is at the file you are interested in, DM commands are invoked simply by hitting appropriate function keys.

The VIEW capability is especially useful, since it filters the unprintable characters in .ABS files; it lets you look at these files without your screen's going insane. VIEW's main purpose, of course, is to look at ordinary ASCII files.

The COPY command not only copies to another disk, but compares the copy with the original to be sure there were no errors. COPY also retains the original flags and file dates, which many find desirable.

When you MOUNT another drive, you can use DM on the files on that disk merely by hitting the function key designated "restart."

I found this program not only quite useful and easy to use, but a lot of fun to experiment with. The only addition I would suggest would be to display the free sectors on the disks, and perhaps the size of the files, when the directory is displayed.

FM.ABS

FM.ABS is a file-maintenance program which permits you to COPY, VERIFY, and/or DELETE files.

FM is a little less easy to use than DM; the user must type in the commands, rather than just hitting the appropriate function keys. However, the typing is made easier since FM, like PIP, permits the use of the * and ? wildcards in the file names and extensions. And it has macro capabilities; so if you regularly perform the same jobs over and over again, you can build disk files of the necessary commands.

FM commands can be suffixed by switches which indicate some desired action. For example, /D will toggle the date switch; this will permit only those files with the current system log-on date to be transferred. The default would be to transfer all files regardless of their dates. The original date is always retained on the transferred files.

You can execute immediate action by typing FM followed by the file names and switches. For instance, to copy a file from SY0: to SY1: and verify that it has been written correctly, you would type

FM /U FNAME.EXT SY1:=SY0:

Or you can get a delayed action by typing FM alone. Then you can take action from the displayed menu. It shows the switches you can use. And free sectors on the destination disk are displayed, as well as the number of sectors taken up by the transferred files. (See Figure 1.)

I found FM especially handy when I was consolidating some of my single-

```
System Date:  ALL DATES  Destination = SY1:  Source = SY0:      FREE =  196

COMMAND:   /U  .???

COMMAND LINE SYNTAX: [/switch] [(-).xyz] [destination = source]
        Switches: /S = Copy                    /V = Verify
                  /T = Copy, Verify & Delete   /W = Verify & Delete
                  /U = Copy & Verify           /X = Delete
                  /R = Reset Specified Drive   /D = Toggle Date
                  /E = Exit Program            /F = Toggle S-flag
```

Figure 1. FM's menu. This was obtained by the author as a screen dump using ET.

Robert Page Carter is a Senior Engineer with AT&T, where he has been employed over 30 years. He's been "hooked on HDOS" ever since buying his H89 four years ago.

sided, single-density disks onto double-sided, double-density. By telling it to copy a file to the new disk, verify, then delete the old file, I was able to easily keep track of the files still to be copied. (They were the ones left on the old disk.) It helped speed up the process greatly, and freed up some much needed disk space!

Neither DM nor FM requires PIP to be present on your disk, unless you want to copy a file under a new name.

ET.DVD

ET.DVD is a very handy utility that lets you send your line printer either a dump of the screen (with CTRL-T) or a line-by-line log of your terminal activity (with CTRL-P).

The CTRL-P feature of this utility does not work with the normal Heath printer drivers. T & E has taken care of that problem by including a general-purpose device driver, GP.DVD, on the same disk. If you already have one of T & E's Maxi-Print device drivers, as I do, you will already be in good shape.

ET cannot be used if loaded into memory with the normal LOAD command. Instead, you must use the command

SET ET: LOAD

SET, then, does the "dirty work" of accessing and loading ET. And T & E found some vacant space in HDOS's own reserved memory area to store ET. This neat loading trick is alleged to save 500 bytes of user memory over a straight LOAD.

Any of you who use only CP/M and not HDOS may wonder why I am enthusiastic over this utility, since you already have the CTRL-P capability. Needless to say, it is a nice addition for us HDOS diehards.

GP.DVD

GP.DVD, as mentioned previously, is a general-purpose printer device driver. It is an addition to T & E's line of Maxi-Print device drivers.

Rather than the usual block-data transmissions used by other drivers, these T & E drivers use line-control protocol and support character-mode printing (single-character transmissions). Single-character transmission is what enables the use of CTRL-P with ET.

These drivers also feature Ecoset, a very handy feature that tells you exactly how you have SET your driver options.

With the conventional Heath drivers, you have to remember what you set; but with Ecoset, you see what you have set each time you change an option or use the SET LP: HELP command.

GP.DVD allows setting the following: number of lines per page; printer port base address; printer communications speed; whether or not to provide form feeds at the end of the file; and whether to operate in continuous-form mode or single-page mode. There is one additional SET command which you would use just once with a particular printer; that is setting the line protocol.

I did not test GP.DVD, since I have the T & E driver specifically designed for my H14 printer. I can speak from experience, however, that if GP.DVD is like T & E's LPH14.DVD, and I understand it is, it is a fine addition to your library.

Because it is general purpose, however, it doesn't support as many SET options as do T & E's specialized drivers. The documentation is a little misleading on this, since it describes most of the typical SET features in the Maxi-Print drivers, then tells you in a footnote the ones you don't have with GP. You must read carefully, or you may think you have features you don't have.

UNLOAD.ABS

UNLOAD.ABS is another excellent addition to the HDOS world. If you have loaded your LP.DVD into memory, and decide you want to change some SET options, all you can normally do is reboot the system and start over. UNLOAD removes most drivers from memory. It allows you to change the SET options, and reload LP.DVD back into the same location.

I have used a public domain unload utility that just erased the device driver's address; you couldn't re-use the memory. UNLOAD doesn't have that problem. The only limitations are that the device driver cannot be a READ/WRITE type (disk drivers), and it must be the last one loaded. So plan ahead: since HDOS loads drivers in the order it finds them in the directory, the ones you might want to unload should be later in the directory than others.

SWAP.ABS

SWAP.ABS will do double duty: it will unload a loaded device driver and either reload it or replace it in memory with another driver. HDOS will recognize only seven device drivers on your system disk. As you would expect, it just chooses the first seven in the directory and ignores the rest.

With SWAP, you can switch one of the drivers that HDOS accepted for one that was ignored. SWAP will recognize a device driver with an .OVL extension as well as .DVD. (The limitations are the same as with UNLOAD.)

SET.MOD

SET.MOD will modify HDOS's standard SET.ABS program so that it will allow SET options to be modified on files with an .OVL extension.

As mentioned, HDOS only recognizes seven .DVD device drivers. So now you can fool HDOS, and add more by using the .OVL extension and the modified SET program. Another handy utility.

Overall

In summary, I was very pleased with T & E's addition to the HDOS utility world.

T & E is one of the few companies actively continuing to support HDOS; although if HDOS 3.0 really comes out, there may be many more believers. (If not, I wouldn't be surprised to see T & E develop HDOS 3.0 themselves.)

Ordering Information

HDOS Enhancements #1 and #2, $30 each or $50 together.
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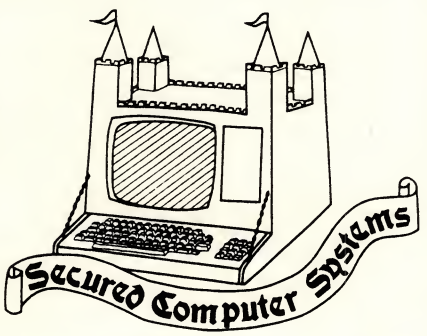

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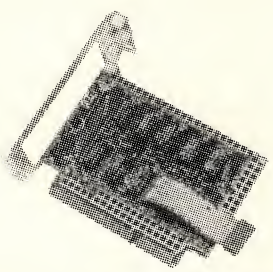

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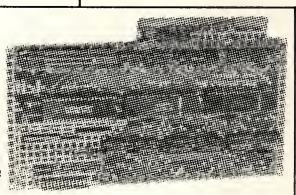

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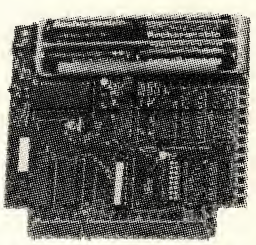

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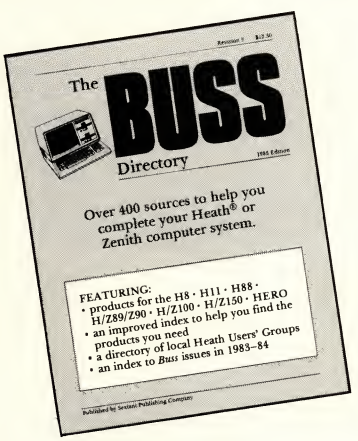
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Z100 Notebook

Alison Phillips

Installing speed kits in the H89 and the Z100

Report on the Del Scientific Z100 High Speed Clock Unit

Tricky trivia

Data compression or compaction

Huffman code

Improve Your Writing with Word Processing

Dick Greenlaw's squeeze program

Proportional printing with non-proportional wheels

PeachCalc logical statements

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XYZZY revisited

Concatenating files

Large PeachText files

Interfacing a serial printer

Installing speed kits in the H89 and the Z100

There are many computer applications in which the speed of the central processing unit (CPU) is not of great importance. But if you have long sorts, extensive number crunching, or long data files to search through, the slowness of the operation becomes annoying, if not intolerable. The H/Z89 with a CPU speed of 2 megahertz is not all that speedy to start with. Add a measure of impatience, and many of us are driven in search of faster CPU operation.

I purchased a 2+4 4-MHz speed module from Najay Systems and installed it in my H89. Even at the cost of $69.95, I consider it among the best computer investments I've made. When I installed the 4-MHz module, I also changed the display rate to 19,200 baud by altering CP/M-80's basic input/output system (BIOS). Together, these two modifications made a new machine out of my H89. I should add that all of the H89's random-access memory (RAM) chips performed satisfactorily at 4 MHz.

A number of speed modifications exist for the H/Z100. There is, though, a greater risk of problems associated with increasing the CPU speed on the Z100 than with the H89. This is because the Z100's 8088 CPU is already working at 5 MHz—instead of 2 MHz, as with the Z80 chip in the H89.

A friend of mine, who is a software engineer, has investigated the methods to increase the Z100's speed and offers this advice: "Normal operation of all Z100 machines is not to be expected by simply increasing the clock speed to 7.37 MHz, or any other speed greater than 5 MHz."

This should come as no revelation, for the original Z100s were designed and tested to meet the 5-MHz clock speed; there was no guarantee on Zenith's part that all of the memory chips and integrated-circuit (IC) chips would perform properly at higher speeds.

This statement is supported by tests that both he and I have performed by changing the crystal oscillator on the Z100 motherboard to 7.37 MHz. We both experienced inconsistent and "flaky" operation. (As you'll see below, I found intermittent problems associated with booting and accessing the 8" drives.) For this reason, I do not recommend Z100 speed enhancers that only change the crystal oscillator—for example, the Del Scientific Turbo Z100 High Speed Clock Unit.

On the other hand, I do recommend the 8-MHz speed kit from U.C.I. Corporation; it is supplied with five higher-speed ICs to replace existing ICs that U.C.I. found to operate marginally in their tests.

The U.C.I. kit enjoys a good reputation among my associates. It may be purchased from the Heath/Zenith Computers & Electronics stores. The price for this kit is $49.95. The U.C.I. kit is certainly moderately priced for what you get and for what it does.

The kit includes a 14-page pamphlet, a socketed circuit board with a 24-MHz crystal, and a tube of five IC chips. The five ICs are used to replace the motherboard's ICs U132, U133, U198, U217, and U110. U132, U133, and U198 are used to interface the memory chips with the S-100 bus; U217 is essentially a buffer and amplifier for logic signals; and U110 is the memory timing control chip.

To install the U.C.I. board, two chips are removed from the motherboard, the U.C.I. circuit board is plugged into their empty sockets, and then the two chips which were removed are inserted into vacant sockets of the U.C.I. board. Because the U.C.I. board is plugged into two motherboard sockets, rather than one (as is the case with the Del Scientific speed kit), greater mechanical stability is afforded.

Unfortunately, on some computers it may be necessary to replace all of the motherboard RAM chips with 150-nanosecond versions before satisfactory operation can be obtained. Also, not all 8088 CPU chips can stand sustained operation at the increased duty cycle of 8 MHz. U.C.I. offers a replacement 8088 CPU which is rated for 8-MHz operation and costs $35.

Report on the Del Scientific Z100 High Speed Clock Unit

I purchased two Turbo Z100 High Speed Clock Unit kits from Del Scientific at a cost of $40 each. The Del Scientific kit allows switching the Z100 CPU clock from its normal 5-MHz speed to "Turbo Boost," which is 7.37 MHz.

One of the kits was installed in an early serial number Z100, probably the first Z100 sold in the Virginia Beach area. The other unit was installed in my Z100, which was delivered August 29, 1984. The kit installed in the older Z100 is working properly at 7.37 MHz.

In my newer Z100, the speed kit worked just great—for two days. Early reports from other units were also good, but as time passed, pleasure turned to disappointment. One by one, the Del Scientific kits installed in the later Z100s failed to operate properly at 7.37 MHz.

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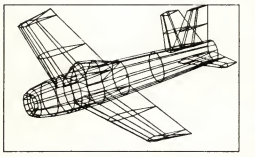

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The predominant failure symptom was the inability to boot from 8″ drives or, for that matter, to read files from the 8″ drive.

During the brief period my computer performed with the Del Scientific kit, the speed increase of the 8088 CPU from 5 MHz to 7.37 MHz was significant and welcomed. I did not get a chance to try many programs, but the PeachText word processor seemed to be speedier at 7.37 MHz, and searches and writing to the disk were faster.

More specifically, I tested the kit's performance on a sorting benchmark written in Z-BASIC; it compares the sorting time for the Bubble sort, the Shell sort, and the Quicksort. Using this benchmark program, I found the sort time with the 7.37-MHz clock unit to be about two-thirds the sort time with normal 5-MHz operation.

Tricky trivia

Do you want to try a quick test of your Z100 I.Q.?

Check your score on these trivia questions on the Zenith Disk Operating System/Microsoft Disk Operating System (Z-DOS/MS-DOS):

(1) How can you ERASE all the files on a disk directory and not use the wildcard *.*?

(2) In what order of precedence does Z-DOS/MS-DOS execute .BAT, .COM, and .EXE files?

(3) Can you name the allowable delimiters in an MS-DOS command line?

(4) How can you type a message on the Z-DOS/MS-DOS command line and send it to the printer without getting an error message?

Are you ready to check your answers? Betcha I gotcha on at least one question. Here are the answers:

(1) ERASE D:\ (where D: is the drive).This works only for MS-DOS version 2—you get an error message with Z-DOS.

(2) .COM, .EXE, .BAT.

(3) There are five delimiters: space, tab, semicolon, equal sign, and plus sign. Each has its application.

(4) Type a period after the command prompt, type CTRL-P, type your message, then type CTRL-N.

You may send me (care of *Sextant*) some concise discovery that you have made and I'll try to include it as a Tricky Trivia question in a future column. If the response is good, I'll add more questions.

Data compression or compaction

Data compression, or compaction as it is sometimes called, takes on many forms.

Take BASIC, for instance. When BASIC files are saved in the default mode (instead of the ASCII mode), the files are written to disk in a form where each keyword (LET, GOTO, etc.) appears as a single "token code" instead of the full character representation of the keyword; this saves disk space and time in reading and writing files to the disk. The BASIC keywords are stored in RAM in a tokenized form when BASIC files are loaded.

As you probably already know, disk operating systems have certain minimum sizes that a file will take up on disk. Under MS-DOS, the minimum file space on 5¼″ and 8″ double-sided disks is 1,024 bytes.

That minimum amount of space is taken up even if only a few characters are written to the file.

To avoid wasting disk space with small files, a scheme has been developed to consolidate a goodly number of small files into a single larger library file. Bulletin boards frequently use this scheme, and a library utility is usually resident on the bulletin board. The library utility permits the user to unbundle the smaller files from the larger file.

Still another form of data compression is the "squeezing" together of characters in a file.

To understand and appreciate how that is accomplished, we need to take a look at the contributions of Huffman and Greenlaw. Ideas of each contributed to the making of two public domain data-compression utilities called SQ.COM and USQ.COM. These useful utilities are available on many local bulletin boards, or may be downloaded from the national Heath Users' Group Special Interest Group (HUGSIG) bulletin board on CompuServe. The Z-DOS/MS-DOS versions are

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in Data Library 6 (DL6).

There are also a number of squeeze and unsqueeze programs available in the public domain. The Capital Heath Users' Group (CHUG) lists Disk 246, "MS-DOS Utilities for the Z-100 and the Z-100 PC," which contains NSQ.EXE, NUSQ.COM, and SQ.DOC. Both NSQ.EXE, the new squeeze program, and NUSQ.COM, the new unsqueeze program, are identified as running on both the Z100 and Z150.

Also, the library of the Personal Computer Software Interest Group (PC-SIG) is an excellent source for public domain programs. Of course, these programs were written for the IBM Personal Computer. But many of the programs will run on the Z150—some with no changes, others, such as the BASIC programs, with minor changes. The same should be true with the Z100 with a D.E.L. or U.C.I. emulator board installed. A few of the PC-SIG programs will run on the Z100

CP/M versions SQ-15 and USQ-15, together with SQUEEZER.DOC, are available on SIG/M volume 60 from the CP/M Special Interest Group (SIG/M) of the New Jersey Amateur Computer Society (not to be confused with the New *York* Amateur Computer *Club*).

Huffman code

It took the obscure David Albert Huffman to develop a binary code based upon the frequency of characters used in a file. (I say "obscure" because I have yet to find the good man's first name or initials in any magazine articles. Both his name and a reference to his code appear in the index of one computer encyclopedia. But when you go to the page, it talks only about the code!)

As you can see from this text, spaces are used frequently in English, as are the vowels "a" and "e", and the consonant "t". If very short codes, some as short as one or two bits, were assigned these and other frequently used characters instead of the standard eight bits, then we could save a great deal of disk space, or transmission time, for this group of characters.

If the rarely used characters required eight bits or even more, that wouldn't influence the data compression significantly if the text were "normal."

But suppose the text contained many z's and q's, or other infrequently used characters—wouldn't the idea behind the Huffman code be self defeating? Not if an adaptive encoder program first scans the file, counts the most frequently used characters, and then assigns these characters short codes.

Since the Huffman code is adaptive, it doesn't matter whether the file is English or binary. But to be effective, there must

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I've done it again—bought yet another book to add to my almost-read book collection. It was written by David and Virginia Noble, and published by the Que Corporation. The book bears the long title of *Improve Your Writing with Word Processing.* With a title like that, I will hereinafter refer to it as *Word Processing.*

Why would I buy a book like that? It is almost a dead giveaway—I can use all the writing help I can get. And besides, I owe it to my readers and to the patient editors at *Sextant* who spruce up these columns.

Actually, the Nobles' book contains something for almost everyone. It is a generous book, containing 406 pages. And for the list price of $12.95, you get a lot of manual for the money. (When I bought technical manuals for the Navy, many thought we bought them by the pound.)

The Nobles' book is not to be read straight through; rather, it is to be used as a source book of ideas and as a reference when needed. It will mean different things to different people.

Both of the authors have impeccable credentials in the field of writing and are strongly oriented towards English and composition. Dr. David Noble earned his Ph.D. in literary criticism, and Virginia Noble is an editor for the Que publishing house, which specializes in computer subjects.

Probably the strongest plus for the book is that it is full of ideas, albeit some of them seem academic and impractical to me.

Some of the academic ideas analyze the structure of paragraphs. If you are moved to read 67 pages on how to "block" paragraphs and to learn that a paragraph needs a topic sentence, then *Word Processing* should be your cup of tea. I'm sorry, but I just can't get into that sort of soul-searching analysis. If my paragraphs are structured a bit like a tree house (fitting sentences like boards in the tree), I hope you'll smile and bear with me.

Use macros

Discussion of macros predominates in *Word Processing*'s content. Macros are short files (in memory or on disk) made up of a series of keystrokes that may be in the form of text or word processor commands. There are about 150 pages in the book that are in some way devoted to macros. The word processing chores that can be done with a macro are boundless.

Macros can be used to do such things as add a letterhead to a letter, or flip two adjacent sentences within a paragraph. A macro may be called at will during the editing session by pressing a key or two. Many of the modern word processors, like Spellbinder and WordPerfect, have macro capability.

I immediately tried out some of the macros listed in the book, and was pleased with the results. Others seemed far too impractical for normal usage. For example, one of the macros consisted of 13 word processing commands to swap two characters within a word. I have to believe that I can overstrike the two characters faster.

If you wonder how macros may be used in word processing, then a tiny sampling of the macro titles covered in *Word Processing* should give you a clue.

Sample titles are: file updater, save & continue, sentence beginning finder, beginning of previous sentence finder, beginning of next sentence finder, sentence marker and highlighter, quick sentence marker—and the list goes on, seemingly without end.

The feature macro in *Word Processing* is one called the "Blockbuster." The blockbuster reformats the entire text so that each sentence within the text stands alone, separated from the others with a blank line. It is supported with a companion program called a "Block Rebuilder." Several versions of these macro listings are provided for different word processors. About 20 pages are devoted to explaining these two macros.

The Nobles suggest that the use of the blockbuster macro makes it easier to find writing flaws and to improve sentence and paragraph structure. I had to find out for myself. So, I "busted" the text you are reading, from beginning to end.

In effect, I converted the text to a separate file consisting of stand-alone sentences in sequence. I found from this experiment that it is easier to focus your full visual and mental attention on a discrete sentence so that deficiencies may be spotted. Also, I found that it is easier to spot out-of-place sentences.

I should hasten to point out that this procedure works best with a word processor, like WordPerfect, which has

be a skew in the frequency of the characters used.

For anyone who wishes to squeeze into data compression and learn more about the Huffman code, there is an excellent book by Gilbert Held entitled *Data Compression*. This book is published by John Wiley and Sons.

Dick Greenlaw's squeeze programs

When you start to download from the data banks associated with various bulletin boards, you are apt to see file names with strange looking extensions such as .AQM and .DQC. No, these are not misspellings of .ASM and .DOC; they're phone-bill savers.

Files with the letter Q in the extension are squeezed. Squeezed files are the result of data compression, which typically shrinks files about 35 percent. Squeezed files result in faster modem transmission and fewer diskettes for archival storage.

But there is a price to pay: namely, it takes time to squeeze and unsqueeze files.

Just in case you run into some squeezed files, it might be advisable to add a version of SQ.COM and USQ.COM to your utility disks. These are public domain programs for which we owe our thanks to Dick Greenlaw for his expertise and generosity.

In Dick Greenlaw's squeeze programs which appear in the SIG/M library on volume 60, the data in the file is treated at the byte level. The data compression is accomplished in two passes. First, the program compresses any series where a single character repeats itself; second, a Huffman code table is dynamically generated to match the properties of the particular file.

Because of the space occupied by the table, it is possible that a squeezed file may be longer than an unsqueezed file. If the squeeze program were used only for ordinary English text, it would be possible to use a constant squeeze code; the table would not have to be a part of the file.

Proportional printing with non-proportional wheels

Can you use a regular printwheel, say an Elite 12, to print proportionally on the Diablo 630?

Yes, you can with the Magic Wand and PeachText word processors.

Will you like the results?

Probably not. At first glance, the text appears acceptable, but a closer examination shows poorly spaced characters.

The word processor tells the printer how many 1/120ths of an inch to move the carriage for each character as it is printed. It seems a paradox, but you must be sure that the Diablo 630's rotary switch is not

dual-screen capability. It is then an easy matter to display the original text on Screen One and the discrete sentences on Screen Two. With this arrangement, the discrete sentences can be analyzed and corrected on Screen Two and then moved to Screen One.

Later, I developed a macro which lets me, by striking a key or two, move a sentence from one location within the text to any other location. This macro is nothing more that an automated block move where the block is actually a sentence which starts at the cursor position.

If your editor doesn't have macros

The Nobles consider macros of great importance to writers using word processors—a concept which must be explored before it can be appreciated. The use of word processing macros, in itself, is an innovative idea. This idea has not found its way into general use because a number of word processors, like PeachText, Volkswriter, MultiMate, and SuperWriter, have limited or no macro capability.

To overcome the inherent macro deficiency of these word processors, the Nobles use a "software enhancer" named ProKey. (ProKey is a product of RoseSoft.) With ProKey, you can define any key as an abbreviation for thousands of characters or command sequences, thus reducing complex commands to simple keystrokes.

To the Nobles' credit, they are specific, and they offer many sample macros where ProKey is used with the previously mentioned word processors to produce some effective macros.

One of the risks associated with macros tailored to a specific version of a word processor is that the macro may be rendered obsolete with a later revision. So it is with their macros associated with WordPerfect. The WordPerfect special function key assignments no longer correspond to those given in the text, but a resourceful user can reconcile the differences.

WordPerfect, Electric Pencil, and XyWrite II are word processors which have inherent macro capability. *Word Processing* lists a number of specific macros for use with these processors. ProKey is not needed to enhance these word processors.

WatchWord on the Z100 also has a powerful macro capability. While it's not mentioned, it should be relatively straightforward to adapt *Word Processing*'s macros for use with WatchWord. (And the same might be said for PIE and EDIT19 on the H/Z89.)

Automating analysis

Word Processing devotes about 138 pages to what might loosely be termed composition and grammar. A chapter is included on analyzing and revising paragraphs, and two chapters deal with revising sentences. The parts of speech, punctuation, grammatical terms, and a glossary of usage are all covered.

Word processing tips are interspersed throughout the book. One example discusses searching for commas so that you may decide whether you've spliced two sentences together.

One tip shows how to avoid long run-on sentences, I would never be guilty of something like that, of course, the editors at *Sextant* attack them with a vengeance—let's wait until they see this. The Nobles list a macro called a sentence splitter, which searches for punctuation marks in order to disassemble a sentence into its parts. This helps to expose run-on sentences. They also list a macro called a sentence restorer, which puts the sentence back together.

Word Processing has a generous index which occupies 14 double-columned pages. Topics are cross-referenced with multiple index entries using selected keywords. This makes it easy to find what you are looking for—one mark of a good book.

Word Processing may not be for everyone. But for the serious writer or, for that matter, for a learner, it contains a storehouse of ideas. Using the book may be likened to shopping at a flea market. If you have time to browse, you are likely to find items of interest and enlightenment.

A valuable lesson that I gained from *Word Processing* is that creating a word processing macro is an imaginative form of programming. It is like creating a batch file with the extended batch commands of MS-DOS version 2. With some word processors—WordPerfect, for example—you may perform conditional commands and initiate counted loops. Macros that employ such commands can be a useful and powerful tool for the sophisticated and trained user.

Improving Your Writing with Word Processing is a good book, reasonably priced, and one that I will visit from time to time. It has added a new dimension to my word processing, and if you are "into" word processing, you too may find it useful.

set for proportional spacing when you want to print proportionally through a word processor that supports proportional printing. (Charles E. Morgan goes into the background in the Letters column in *Sextant* #16, May-June 1985.)

The Diablo's rotary switch should instead be set for 12 characters per inch. This way, the printer's intelligence will not be in conflict with instructions sent by the word processor—which would cause the line lengths to go astray.

With the Diablo's proportional spacing switch turned off, and the PeachText PROP ON command enabled, many of the words print beautifully when using the Elite 12 printwheel. But others, such as the words "memory" and "command," seem stretched out. Others, such as "title," may seem scrunched together. The trouble is caused by the fact that Elite 12 characters are all the same width, whereas there are slight differences in the widths of characters on a proportional wheel.

Take the lower case i, for example. On the Elite 12 wheel, the i has a bar across the bottom which can cause it to run together with some adjacent characters. And all capital letters on the Elite 12 wheel are shaped to be printed at the same width (pitch) as the lowercase letters. But this is not so on a proportional-space (PS) wheel. The letters occupy different widths; an m is quite a bit wider than an i, for instance. Moreover, all capital letters on a PS wheel are of larger size and they print wider. (For more on proportional printing, see my "Z100 Notebook" column in *Sextant* #15, March-April 1985.)

PeachCalc logical statements

The PeachCalc spreadsheet program is part of the PeachText 5000 package. It, like the SuperCalc spreadsheet, allows the use of logical statements which include AND or OR in a conditional statement. Conditional statements are easily recognized by the word IF. But how are such conditional statements entered?

The general form for PeachCalc conditional statements is:

IF (expression1, expression2, expression3)

This general form leaves much unexplained when it comes to syntax, and that is why I would like to share with you the example given below. It is shown in two steps for clarity.

```
IF(AND(CONDITION1,CONDITION2),
  EXPRESSION2,EXPRESSION3)
IF(AND(A1>10,D2<20),-5,10)
```

Count the three commas in the first statement and note how they delimit each condition and expression. Then note that the three commas in the second statement do the same thing.

Translated into English, the second statement says: IF A1 is greater than 10 AND D2 is less than 20, then put the value –5 in the current block; if not, put the value 10 in the current block. Here the symbols A1 and D2 represent block (or cell) coordinates on the spreadsheet. The English translation sounds a lot like a BASIC conditional, but Oh what a difference in syntax.

Online Today

Online Today is a monthly magazine published by CompuServe with a cover price of $2.50. The annual subscription price is $30 for non-CompuServe subscribers. CompuServe subscribers receive a free introductory subscription when they sign up for CompuServe.

Online Today runs about 50 pages per issue, and is devoted to computer communications. It contains helpful hints for using CompuServe and keeps the user updated with data bank changes and changes in operating procedures. The magazine contains several feature articles.

A recent issue contained a printer review and a review of a word processor, as well as several excellent book reviews. The review of the book by David Stone entitled *Getting Online* should warn prospective buyers away from this book. The reviewer said, 'Heavens, this is a terrible book. So bad, I hardly know where to begin.' I have seen the book and tend to agree with his assessment.

Regular departments of *Online Today* include letters, a beginners' corner, computer games, answers from customer

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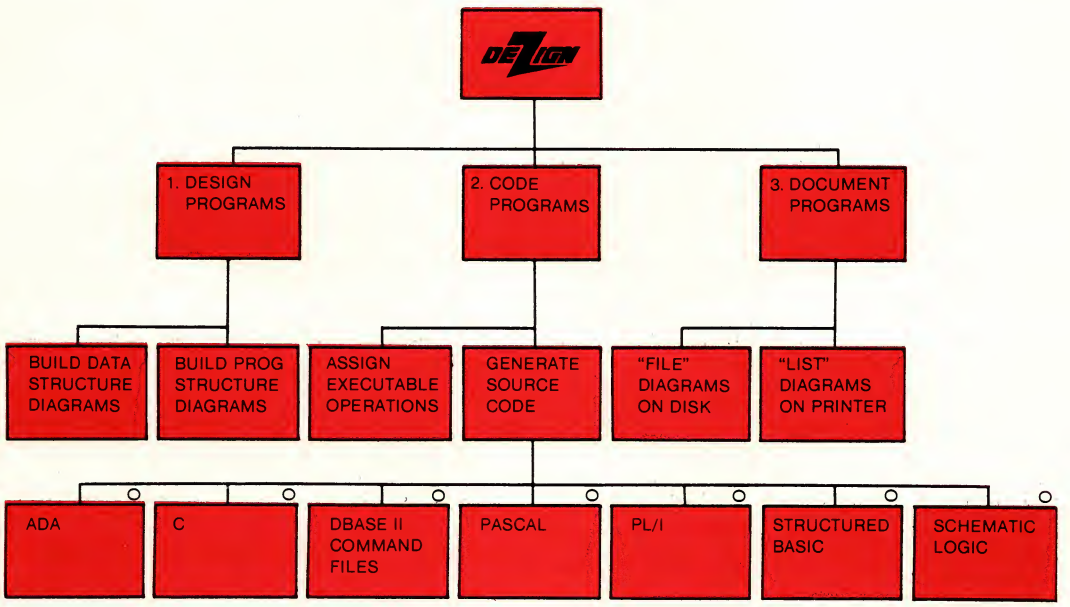

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service, new product descriptions, a shoppers' guide, an industry watch, and updates on 'The Electronic Mall,' CompuServe's shopping service. All in all, my first impression is that it is a nice informative magazine. But then I am a soft touch for computer magazines; I guess I subscribe to at least a dozen magazines and newsletters.

XYZZY revisited

I had an eerie feeling when I broached the subject of "XYZZY ON" in *Sextant* #15, March-April 1985. I felt that something strange was afoot, and that there was more to this command than met the eye. Little did I know that I had inadvertently stumbled upon the powerful magic word used in the original Adventure game.

A number of you pointed that out. (See "Letters" in *Sextant* #16.) And Dr. Glenn F. Roberts, a computer professional as well as a true hacker, set me straight. He pointed out to me that the magic word XYZZY will instantly transport the Adventure player from the dangers of the underground cavern to the comfort of an aboveground building, where you may safely leave your treasures before continuing on.

I envy those, like Dr. Roberts, who got into the computer profession (or game, as may be the case) early on. Dr. Roberts went on to say that playing Adventure holds a special place in the hearts of many, by kindling an excitement about the unbounded horizons of the world of computing.

Tracy Kidder, in his 1982 Pulitzer Prize-winning best seller *The Soul of a New Machine*, tells of the heroic, around-the-clock struggle that Data General's engineering team made in the development of the Eagle computer. In this captivating book, Ken Holberger, a team heavyweight, played Adventure on the developing Eagle to test it out.

Another reader alerted me that the Heath Disk Operating System (HDOS) has a surprise awaiting those who issue the HDOS command SET HDOS STAND-ALONE (which makes it possible to put a new disk in place of the system disk). HDOS responds with a quote from the Adventure game: "It is now pitch dark. If you proceed, you will likely fall into a pit."

It seems obvious now that those minds that ushered in the world of computing carry with them a nostalgic urge to bring to the present a bit of the past, first into HDOS and then into MS-DOS.

The mystique of the past is maintained in the undocumented MS-DOS XYZZY ON command, which allows checking the return code from a program.

The return code provides a mechanism for a so-called "child" process to communicate information back to the "parent" process. The return code is a number to indicate whether or not the program has executed; 0 usually signifies a normal return (no errors), and other numbers signify some sort of failure.

Dr. Roberts states that any program can load another program and pass execution to it as its child program. This is accomplished by a special MS-DOS function, "Load and Execute a Program" (code 4B hexadecimal).

This function is explained on page 4.154 of the manual provided with the MS-DOS Programmer's Utility Pack.

It is important to note that COMMAND.COM, the keyboard command processor, is the "parent" process for .COM and .EXE programs and that these programs return to COMMAND.COM. The XYZZY ON command is a way to tell COMMAND.COM to print the return code when a "child" process program is run.

The parent process can retrieve a return code from a child process using the MS-DOS function call 4D hex, "Retrieve the Return Code of a Child." The code returned by this call is a 16-bit quantity. The low byte is the 8-bit exit code, and the high byte is one of the following:

0 – Terminate/Abort
1 – Control-C hit
2 – Hard error occurred
3 – Terminate and stay resident

The return code is the same code that is accessed by the ERRORLEVEL parameter used with the batch-processing IF command resident in MS-DOS. See page 11-

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220 of the MS-DOS manual furnished with the operating system.

Concatenating files

"Catenate" is a word that has been used since the year 1623; it is a verb meaning "to link." "Concatenate" means to link together as in a chain. A chain suspended between two fixed points forms a catenary span.

Files can be concatenated in a number of ways.

Users of CP/M may use the PIP command to concatenate files. This is a particularly powerful command, but rather hard to master fully since it has 19 switches. The early documentation furnished with the H89 did little to ease the learning difficulty.

MS-DOS's COPY command is not nearly so powerful as CP/M's PIP command, since it has only one switch (/V for verify). (You may forget the verify switch forever if you include the VERIFY ON command in your AUTOEXEC.BAT file.)

Both the Z-DOS and the MS-DOS manuals do a good job of explaining the power of COPY. When desired, several files can be concatenated into a single file by a command such as:

```
COPY FILE1.TXT + FILE2.TXT + FILE3.TXT
B:CHAP1.TXT
```

It is possible to use a word processor such as PeachText to concatenate text files, as when using PeachText's C <FILE NAME> command. But an awkward situation develops when the concatenated file causes the file as a whole to exceed memory space.

Large PeachText files

Many word processors will manage very large files because they have methods of reading a section of a file from disk to memory and then writing a section back to disk as the next section is read to memory. But useful as this may be, it has its price in that it can become awkward and tedious. The really useful part of a file is that which resides in memory and can be immediately searched, moved, and corrected.

The way PeachText handles large files requires you to issue a Write command to open a new file name to be maintained by PeachText as your output file. Then the Read command is used to read into memory sequential portions of the main file. This process is one-way. To get to the top of the file once it has been sent to that output file, you must END the editing session and start a new one.

When PeachText is used with the Z100, it allows a maximum file size, in memory, of 54,287 bytes. From a practical viewpoint, it is not advisable to go beyond 50,000 bytes because of the risk of losing flexibility. Additional memory space may be needed just to add a line here or there.

Suppose the file size is in excess of 50,000 bytes and you need to move a block of text. You may run out of memory while

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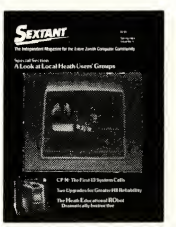

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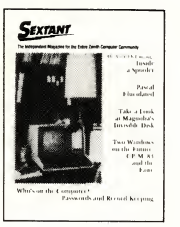

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attempting the block move because the block must be read into memory, which is nearly full so far as PeachText is concerned. Even if you have a 256K memory board installed in the Z100, PeachText will be oblivious of that fact.

If you have a file that is slightly less than the maximum allowed (say, 52,992) and attempt to load and edit this file, you will receive the message "More of document on disk—use R to read as needed". In other words, PeachText knows that it takes some room to work a file, and in this case it will reserve 1,295 bytes.

Now assume you want to move the last paragraph of this large file so that it becomes the first paragraph. The last paragraph, however, is still on the disk. In PeachText's way of handling large files, you must write the first section of the file to disk before you can read the last section into memory. This creates an impossible situation.

One solution is to divide the large file into two smaller ones. After the file is divided, you may edit the last part and make a block save (XB=LAST.PAR) of the last paragraph. Next, edit the first part and Include the last paragraph (ILAST.PAR). This awkward procedure illustrates the wisdom of holding down file size to less than 50,000 bytes so that paragraph moves can easily be made.

I have found it desirable to write text in the form of short files of 15K or less. Working a file of this size is quick and convenient in PeachText. When desired, these short text files, or modules, may be concatenated into a larger file and the spelling checked in the larger file in a single operation.

Interfacing a serial printer

Configuring the operating system—whether it be CP/M, Z-DOS, or MS-DOS—for a printer using the RS-232 serial interface can be easy or it can be frustrating.

All three of these operating systems have a CONFIGUR program; when invoked, it alters the input/output portion (IO.SYS) of the operating system. After the alteration is completed, the altered I/O system can be written to disk to take control each time the system is booted.

If your printer is one that Heath has already provided for and listed in the operating system's CONFIGUR menu, then all you need do is make the proper menu selection, save it to disk, and the job is done.

The discussion which follows assumes correct cabling and relates to the CONFIGUR prompts of the MS-DOS operating system. However, the responses are applicable to Z-DOS and CP/M.

If your printer requires a serial interface and does not appear in the CONFIGUR menu, then you must select the "user defined" option from the menu. Then you will be faced with a series of questions that can be intimidating to the uninitiated. You will need to know what signals the printer

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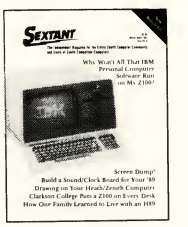

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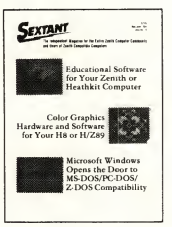
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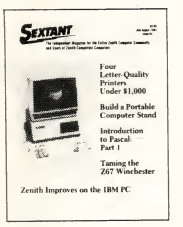
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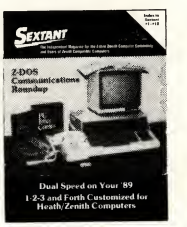

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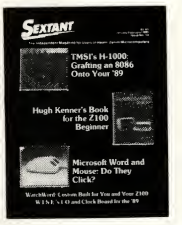
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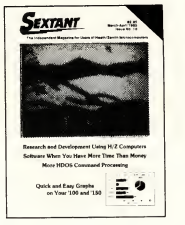

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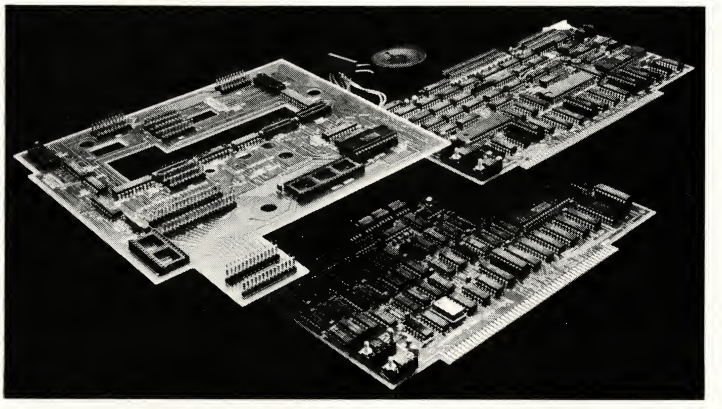

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expects from the computer, and also how the printer itself is configured.

Sometimes it is necessary to resort to trial and error in order to respond correctly to the configure prompts. But relying on chance alone to make the correct answers can be time consuming. Here are a few tips which may help to reduce the number of trials required.

Most Heath/Zenith computers do not use parity when talking to the printer, since the low communication speeds (9600 baud or lower) and short distances reduce the chance of error in transmitting or receiving data. As a general rule for Heath/Zenith equipment, you can respond with NO to the prompts which ask whether you want to use parity and ask whether you want to strip the parity bit in both the input and the output.

There are two CONFIGUR prompts which relate to the mapping of lowercase characters to uppercase, and the mapping of uppercase characters to lowercase. Unless you really want to change the case of the characters sent to the printer, the answer is NO to both prompts.

Baud setting is not a consideration with a parallel interface; but with the serial interface, the communication speed of the computer and the printer must match. The output baud setting from the computer must be selected from the options in the CONFIGUR menu. Sometimes the printer's baud setting can be changed using the printer's DIP switches.

If the printer's output is gibberish, check to see if the communication speeds match. Some printers that are supposed to handle a high communication speed (up to 19,200 baud) may not do so in practice. If anomalies occur in the printed text, try reducing both computer and printer communication speed.

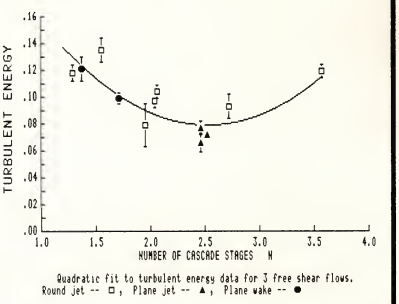
Hardware handshaking between printer and computer is used on nearly all of today's printers. With hardware handshaking, a predefined high or low voltage is placed on a given pin in the RS-232 cable. You can choose one of four hardware handshaking options: positive or negative RTS (pin 4), or positive or negative DTR (pin 20). (RTS = Ready to Send, DTR = Data Terminal Ready.)

If you can find the protocol in the printer's manual, the correct option can be selected on the first try. The DTC 380Z and the MX-80 printers use DTR positive. If the printer's documentation does not help, then go ahead and try each option in succession.

With the serial interface, each bit of a character is sent to the printer one after the other like ducks walking in a row. A stop bit is used to tell the printer when all the bits of a character have been sent.

When the CONFIGUR program prompts you for the stop value, select one stop bit; this is the proper response nearly all the time. Two stop bits are needed only with very low transmission rates, normally 110 baud.

GRAFIT/FITFN



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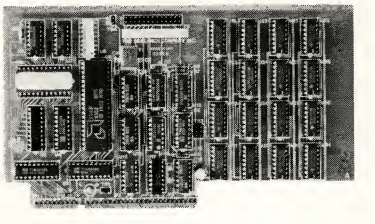

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Circle #116 on Reader Service Card

(The 1.5 stop-bit option is a carryover from teletypewriter transmission. The stop bit is just a voltage level or frequency held for a certain amount of time. So it's possible to speak of "half a bit.")

One of the confusing prompts presented by the CONFIGUR concerns the use of pad characters. You are asked to select a pad character and to enter the number of pad characters needed.

Pad characters are the equivalent of nulls. It takes the printhead considerable time to return to the left margin after receiving a carriage-return command. If the printer does not have a built-in buffer, the computer will keep sending out characters to print while the printhead is travelling to the left, and characters may be lost.

By chance, you may need to configure a printer with no buffer. If so, you may need to send a few nulls. These are simply "nothings" to give the printhead time to "home" to the left side before it starts printing again. On these older printers, you may have to experiment to find the minimum number of nulls to use.

Most printers do not need nulls outputted to them after a carriage return since nearly all newer printers have a memory buffer of some size to receive characters while the carriage is being returned. Communication to this buffer is turned on and off as needed by the handshaking protocol. If you have one of the newer printers, you can safely press RETURN and then 0 in response to the prompts. △

Sources Mentioned

Capital Heath Users' Group
P.O. Box 16406
Arlington, VA 22215-1406
703/339-9857 (recorded message)

CompuServe Information Service
P.O. Box 20212
Columbus, OH 43220

Del Scientific, Inc.
4919 Mussetter Road
Ijamsville, MD 21754

Diablo Systems Inc.
A Xerox Company
P.O. Box 5030, Mail Station FM-249
Fremont, CA 94537
415/498-7496
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Diablo Systems Retail Store
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Najay Systems
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West Covina, CA 91792
714/594-9564
(H89 speed module)

Online Today
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Columbus, OH 43216-0639

PC Software Interest Group
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Sunnyvale, CA 94086
408/730-9291
(Public domain software disks)

RoseSoft
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Seattle, WA 98105
206/524-2350
(ProKey)

SIG/M
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Clifton, NJ 07015-2085

U.C.I., Inc.
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800/UCI-COMP
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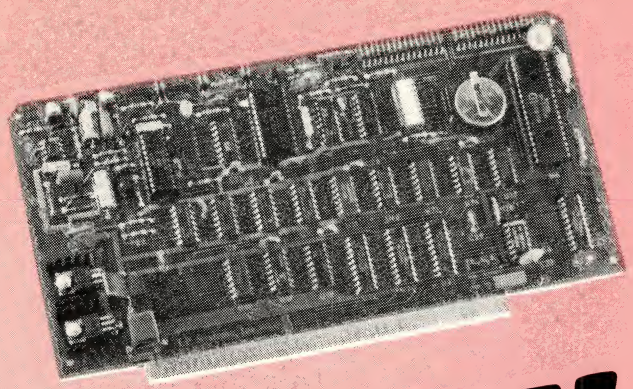

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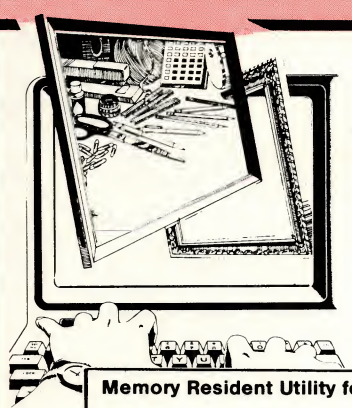

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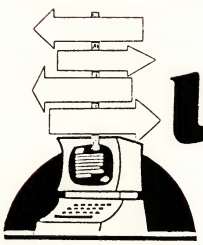

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Circle #204 on Reader Service Card

More Disk Capacity for Your '89

The hardest part is deciding which route to take.

Raymond Dotson

Remember the day you first fired up your shiny new H89? Remember the pride you felt when the big "H:" appeared at the top left corner and you heard the "beep beep"? Just like the wizards at Heathkit said it would be!

You had the justifiable pride that comes with ownership of a fine piece of high-tech computer equipment, as well as pride from the knowledge that you had constructed it yourself.

Did you, like me, marvel at all that available storage space on the floppy disk (strange term, that) which came packed with the computer? Nice of Heath to give us a disk to write all our programs on! Wonder if we'll ever fill it up? One hundred twenty five thousand bytes of storage on one disk! Wow!

But then, after a few months, I found I had purchased numerous boxes of disks and was constantly requiring more. Somehow those programs kept piling up. The data files were daily getting larger and requiring more disk space. What to do?

We've all fretted about not enough disk space, and I'd like to discuss the choices we face and offer some suggestions.

I thought I had found the solution when I found that Zenith had the Z89-37 double-density drive-controller board available. My old disks were formatted single-density. The new board would let me format each disk for double the space.

But what's that you say? The new board is for soft-sectored operation? My old disks are divided up into ten fixed sectors: "hard-sectored." Soft-sectoring lets the operating system divvy up space more efficiently. I'll have to change from the hard-sectored disk format to soft-sectored? And buy new disks? And what's to become of the dozens of disks I already own?

I discovered that the drive mechanism is *not* the determining factor for hard- or soft-sector operation. The drive controller does that! I need a new drive only if I want to switch to double-sided disks, or if I want to go to the newer 80-track disks (with 96 tracks per inch).

Then that must mean that I can use my original drive as either hard- or soft-sector, single- or double-density, depending on which controller I use.

Of course, with the Z89-37 controller, I will still have a maximum of only 148 kilobytes of formatted disk-storage space. And I must buy all new soft-sectored disks.

There must be a better way!

Three choices

The purpose of this article is to show that there *is* more than one method of extending the available disk capacity, depending on your budget. The options are as follows: (1) new controller board, old drive; (2) new board, new drive; and (3) old board, new drive (and some software).

> ***What's to become of the dozens of disks I already own?***

(1) You may purchase a Z89-37 or equivalent double-density disk-controller board. With your original H17 drive, you will have a maximum storage of 148K per disk.

The quality of the Z89-37 has been excellent when used with 40-track drives. Unfortunately, Zenith is no longer offering it. They are, however, keeping to their policy of supporting a product for seven years after discontinuance. So the parts are still available.

T.M.S.I. of Ann Arbor, Michigan, therefore, has been able to buy the parts in order to include the board in one of their systems. They are also making the Z89-37 available on its own as a special-order item. I haven't worked with T.M.S.I., so I can't give you any firm idea of how long a custom job like this should take. They estimate a four-week wait; you should contact them for details before ordering.

Also, a few other manufacturers are selling controllers which perform similar tasks. (With the Heath/Zenith board put together by T.M.S.I., your expenditure is approximately $300, plus all new disks.)

(2) With the double-density controller, you may replace the original drive with one or two internally mounted half-height double-sided drives.

If you do, I strongly recommend that you purchase 40-track (48-t.p.i) drives for use in the double-density format. This is due to diminished reliability when operating both double-density and 96-t.p.i. with internally mounted drives. Perhaps you are aware that Heath/Zenith did not incorporate the 80-track drives into the Z100s.

The 40-track drives will give you a total file area of 304K per disk, 608K total available at any one time. (Two drives cost approximately $240, plus an additional $300 if you don't already have the controller. Careful shopping can get the price of drives down to as low as $200.)

(3) You can utilize double-sided drives with your original H17 hard-sector controller. To do this, you can get a modification to CP/M's basic input/output system (BIOS). Or you can get a device driver for use under the Heath Disk Operating System (HDOS).

As in option 2, you may add one or two internal drives. With this option, though, you *must* use hard-sectored disks.

And you will probably want to select 80-track drives since you will not have the double-density feature available. In this mode, you will have 388K available file space per disk. Unless you already own a double-density controller, this will undoubtedly be the most cost-conscious update. (It costs approximately $300 for two drives and your choice of software drivers.)

In any of these options, you may continue to use your original drive mechanism as an externally mounted third drive.

Looking at these alternatives, it's too bad most of us will have to pass up number three with 80-track drives and double-density disks. It would give us the most

---

Raymond Dotson is a ZDS dealer in Goldsboro, North Carolina. His previous articles for Sextant *were on BASIC programming—see issues 1, 2, 12, 13, and 14.*

Item	Suggested Vendor
Half-height drive (double-sided/double-density)	Computer Hut
Dual-drive adapter plate	Computer Hut
"T" power adapter	Payload
34-pin connector (#276-1564 A)*	Radio Shack
Data cable (#HE 134-1247)**	Heath Company
#3 8mm pan-head machine screws	Local sources
Z89-37 drive controller (double-sided/double-density)	(See text.)
BIOS-80 (modified CP/M BIOS)	Quikdata
DKH17V4.DVD (HDOS driver)	Quikdata
Utility package	Author

* Required only if you are to construct parallel data cable from your original HE 134-1074 cable.

** Not required if you are constructing parallel cable.

Table 1. Parts list for the drive addition.

disk space for the dollar. But unreliability is a high cost to pay for a "paper" advantage.

Looking at the choices, then, it appears that number three gives us the best in price and performance. It gives us 388K per disk, it's reliable, and we can still use our old controller board and hard-sectored disks.

What were we waiting for?

If it's all so simple, why didn't we do something long ago?

The reasons are twofold. First, we didn't always have a modified CP/M BIOS and the HDOS device driver available.

Second, it wasn't always as economical as it is now. You may have noticed that prices for high-quality Japanese-made disk drives are coming down nicely. Firms like Teac and Panasonic are world leaders in the manufacture of precision tape transports and phono turntables. Some of the newer double-sided, half-height drives are available as of the date of this writing for as little as $100. They are of superb quality and workmanship and deserving of our consideration.

The software

Now for the software modifications. Ray Livingston of Livingston Logic Labs has written a modified version of the CP/M BIOS, which he calls BIOS-80. For HDOS, there is a similar product from Dean Gibson of UltiMeth Corporation, the DKH17V4.DVD device driver. This is used instead of your present SY.DVD. (*Note:* I suggest you not purchase the version of this extended device driver from the national Heath Users' Group; it is Dean Gibson's original and drastically outdated version.)

A great deal of credit is due to both these individuals for the pioneering work they have done in an area which Heath/Zenith had totally ignored. Until they came along, Heath users had no way of getting more than 100K per disk. (The Z89-37 controller board came later.)

Both of these products are available from Quikdata Computer Services, of Sheboygan, Wisconsin.

BIOS-80 or DKH17V4.DVD software may be your best route to expanded disk capability. Consider your options and available funds.

Table 1 is a summary of parts used to implement the three options, plus sug-

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gested sources. This list has been carefully screened and consists of vendors who have provided both low prices and technical help to this writer. I have found that low price alone is not the final determination of my sources. I don't like to feel all alone out there when something doesn't work and the vendor can't (or won't) provide technical help or replacements.

For our purposes here, I will assume that you are to be adding at least one new internal, half-height, 40- or 80-track drive. If so, follow the procedures below for hardware modifications.

Putting in internal drives

The mechanical work required in this update modification is minimal. *Start by unplugging the computer from the power line.* Next, unplug your original drive, both from the power supply and the disk controller. Remove the two top screws holding the magnetic shield (steel bracket with bonded copper sheet) to the drive frame. Next, remove the two screws on the outside of the drive and gently slide it out the front of the computer. I suggest you now place the old drive in a cardboard box for protection.

Remove the magnetic shield and mounting bracket by removing the machine screws which hold the bracket to the computer front panel.

If you are installing only a single half-height drive at this time, the adapter plate and drilling discussed below will not be needed. The single drive will be mounted on the right side of the opening. A blank panel is fitted into the left half of the opening where the second drive would normally be placed. Although the magnetic shield is not touching the left side of the drive, adequate shielding is provided for optimum operation.

If you are installing dual drives, you will be drilling holes in both the magnetic shield and the mounting bracket; this must be done well away from the computer for obvious reasons. Metal particles from the drilling could reduce your computer to a 60-pound door stop.

First you will need a double-drive adapter plate. This will be used to lock the two drives together. Place it on top of the magnetic shield in such a way that the left-hand two of the adapter's elongated holes are centered exactly over the two holes of the shield. (See Photo 1.) Then, using the adapter plate as a template, mark through the center of the other two holes onto the copper foil. This will mark the spots where two ⅛" holes must be drilled in the magnetic shield. Line up the shield's original holes at one end of the adapter's elongated holes; then make sure the new ones are drilled in the same relative location.

In a like manner, mark and drill two holes in the same position on the mounting bracket.

When the drilling is completed, and when the adapter plate and the magnetic shield are superimposed, you should have four holes each centered exactly underneath the four holes in the adapter plate. Check that there are no metal particles clinging to the shield, and remove any burrs that may be around the holes just drilled.

Photo courtesy of the author

Photo 1. The adapter plate is placed on top of the magnetic shield to serve as a template for drilling two new holes in the magnetic shield. The original holes are on the left. The new ones will be on the right.

You must obtain a parallel double-drive data cable to connect both the internal drives to the drive controller. This may be purchased from Heath or other vendors, but I suggest you make your own. All you need to do is splice another plug into your current cable, turning it electrically into a "Y" cable.

If you make your own, you can obtain the 34-pin plug from your local Radio Shack store as indicated in the parts listing.

Place the plug on your original data cable (Heath part number 134-1074). It should be 1½" from the similar plug now in place, and facing the same way. Close the new connector's rear snap plate by hand until it is snug. Ensure that the new plug's piercing pins are aligned with each wire in the ribbon cable.

Now that it's on the cable, place the new connector in the jaws of a vise; tighten the vise until you hear the snap plate click into final position. The piercing pins should have cut through the cable's insulation and connected with each wire. Use an ohmmeter to check for continuity between each pin of the new connector and the corresponding pin on the original. If all is in order, your data cable is now complete.

Remove the two half-height drives from their protective shipping foam and place them upside down on the work table. (You should note that the accompanying photos show Teac drives which are installed with the red lamp assembly at the *bottom.* Other brands may require a mounting scheme with the lamp at the top. Check your technical data for mounting information.)

Temporarily mark one of the drives "A" and the other "B". Consult your drive data sheet to determine the location of the resistive termination plug on drive "B" and remove it from its socket. Place this "B" drive so that it will be the right-most drive when installed. Using four #3 8-millimeter machine screws, attach the adapter plate to the bottom of the drives. Ensure that the drive fronts are properly aligned and touching each other, then tighten the four screws.

Replace the magnetic shield and mounting bracket in their original position. Place the drives upright and slide them partially into the opening on the front of the '89, being careful to hold the magnetic shield out of the way.

You will possibly need to file two small notches into the bottom of the computer front panel disk opening to clear the screw heads securing the bottom adapter plate. If so, mark the position of the screws, remove the drives, and do the required filing at this time.

Plug the power adapter into the original computer drive power socket and then into each of the new drives. Plug the data cable into the drive controller and into

each of the new drives, observing polarity. (*Note:* Different manufacturers use different orientation of the drive data plug. Check your data sheet and ensure that polarity is correct. You may need to make a half twist in the cable between the controller and the drives.)

Slide the two drives the remainder of the way into the mounting bracket and shield assembly.

Hold the faces of the drives flush with the computer face and install two #3 8mm machine screws through the brackets into the side of the outermost drive. Install two more screws in the tops of each drive through the magnetic shield. Again check for proper alignment of the drive faces and tighten all screws.

If you are using the Z89-37 drive controller, move the jumper from J4 to J6 on the controller board. This jumper determines which drive is controlled from plug P3. Move the long extension cable connected to the rear panel from P4 to P3. Connect our newly installed internal drives to P4.

By installing the jumper at J6, you will be permitting both your internal drives to be controlled from P4 and any external drive will be from P3. If you have already been operating from the Z89-37 controller, no other re-programming should be required of it. Otherwise, follow the instructions provided with the controller.

Reconnect the fan and attach the computer cover. If everything has been assembled properly, your computer should operate in the usual manner except with greatly increased disk storage capacity. The completed two-drive update is shown in Photo 2.

Photo courtesy of the author

Photo 2. The new drives in place.

Other things

While you're getting more disk space, you can get more speed, too. Your original H17 drive may have felt comfortable taking up to 30 milliseconds to step between tracks. The operating system was configured to accommodate this.

You will now be able to use CP/M's CONFIGUR.COM utility to reset the step rate for the new drives to 6 ms. You may try 3 ms if you wish. Some of the new drives will access at 3 ms; however, I find greater reliability at 6 ms.

You will also be able to read or write single-sided as well as double-sided disks with equal ease. The double-sided drive is fully compatible with both. Use FORMAT.COM as usual, except now you will specify two sides in response to the prompt. SYSGEN.COM will automatically write your directory tracks for double-sided use.

I strongly suggest that you never skimp on disk quality. It only takes one instance of a crashed program to prove the value of this practice. I have found, however, that top-quality single-sided disks will usually work equally well as double-sided disks.

Don't let the word "usually" scare you. A CP/M disk-sector-lockout utility (see below) can be used to determine if any disk has a defective or even marginal sector.

Simply use the utility after you FORMAT and before you SYSGEN. Any imperfect blocks that might be on either side of the disk will be grouped together into a hidden file. In actual practice, I have had only one of over 100 disks, rated as single-sided, show defective sectors on side two.

Some helpful utilities

I have available a disk of special CP/M utilities that you should find most helpful with the new updated H89. Some programs are written in "C," some in assembly language, and some are in compiled Microsoft BASIC. All are directly executable .COM files. Included are formatting, justification, printing, scrolling, sorting, and disk cataloguing utilities with documentation where needed.

I will also include two free public domain utilities called FINDBAD and UNERASE. These are excellent programs which will locate and lockout bad sectors, and restore accidentally ERASEd disk files. The cost for all these programs, including copies of the free public domain software, is only $24.95.

Try it

To recap, any drive may function as either single- or double-density, hard- or soft-sector, determined by the controller interface. We have numerous ways of increasing our disk storage.

A modified BIOS for CP/M or a new software driver for HDOS will enable us to use our original H17 controller for single- or double-sided drives, hard-sector only. Or we can add a double-sided, double-density controller interface such as the Z89-37. We also have a simple and economical method of mounting one or two half-height double-sided drives internally in the H89 in the same opening originally holding the single-sided H17 drive.

If you are operating on a tight budget, perhaps you would like to follow my lead and update your H/Z89-90 to this more modern configuration. The result is a remarkable increase in disk space and ease of operation, *and* a very professional finished product.

Ordering Information

CP/M utility package, $24.95. Specify hard- or soft-sectored format when ordering.
Ray Dotson
Array Software
214 South Berkeley Boulevard
Goldsboro, NC 27530
919/778-4112

Drives, adapter plate
Computer Hut
101 Elm Street
Nashua, NH 03060

Power adapter
Payload Computer Services
15006 Sun Harbor
Houston, TX 77062
713/486-0687

BIOS-80 and DKH17V4.DVD, $40 each plus $2 shipping and handling.
Quikdata, Inc.
2618 Penn Circle
Sheboygan, WI 53081
414/452-4172

Z89-37 drive controller, $300.
Technical Micro Systems, Inc.
777 East Eisenhower Parkway, Suite 320
Ann Arbor, MI 48104
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Circle #158 on Reader Service Card

Del Scientific Speeds Up Your '100

The Turbo Z100 High Speed Clock Unit gives you a choice of 5, 6, 6.67, or 7.37-megahertz speeds.

Jeffrey Goldman

We are always looking to speed up and upgrade our computer systems by various methods: memory disks, hard disks, co-processors, etc.

The problem with most of these is that they cost a lot of money. If you're like me, after you spend the money on your computer, you don't have a lot left—because you have already bought as much computer as you can afford.

The solution to this problem may be found in this and other publications covering the Z100 computer. What I am talking about is speed-up modules for the 8088 central processor unit (CPU) in your Z100. In recent issues of *Sextant* and *REMark*, there have been at least two or three ads for modules that will boost the processor speed of your 8088 from its current speed of 5 megahertz up to as fast as 8 MHz (a potential increase of 60%).

What I will try to do in this article is give you some idea of the difficulty (or ease) of installing one of these in your computer, based upon my experiences with the one I chose: the Turbo Z100 High Speed Clock Unit by Del Scientific of Ijamsville, Maryland.

(Another one, the ZS100 from C.D.R. Systems, was reviewed by Wayne Rash, Jr., in *Sextant* #16, May-June 1985. See "Speed Up Your '100 50%.")

The Del Scientific unit boosts the clock speed up to 7.37 MHz. I chose it over some of the higher speed units for one reason: the certainty it would work—that it would give me at least some significant speed increase.

A lot of the units have a disclaimer saying they may not work with slower memory chips or with an old 8088 processor. The Turbo unit comes with a slower crystal for a boost to 6.67 MHz (33% increase), in case the new crystal oscillator does not work.

If neither one of those works, you can send them both back for a crystal to boost it to 6.00 MHz (20% increase). Del Scientific says you may have to use one of the slower crystals with some RAM expansion boards.

Finally, the high-speed clock unit comes with a 60-day warranty.

A little background

I will cover some of the problems I had installing the unit as well as the benefits of having one of these installed in your computer.

The module generates clock pulses at 22.12 MHz for an overall clock speed of 7.37 MHz.

In order to give you some idea of how hard it will be for you to install a module in your computer, I will outline my system and past experience. I have a Z100 low-profile computer with two half-height floppy-disk drives and 192 kilobytes of random-access memory (RAM), a Zenith ZVM-135 color monitor, and an Okidata 92 printer.

(If your system has eight-inch disks, you may want to look at comments by Alison Phillips elsewhere in this issue. See "Z100 Notebook," page 39.)

Prior to purchasing my computer in the summer of 1984, I had no previous experience with microcomputers, and my only programming experience had been an introductory course eight years before in college.

I bought the Turbo unit at the Western Regional HUG Conference held in Anaheim, California in November, 1984. When I got home and opened the package, I found one module with a crystal in it with a long wire attached to a switch. I also found a second crystal and a 10-page set of instructions that had been prepared on a letter-quality printer.

The module installs on the motherboard at chip location U236; it plugs into the socket occupied by an 8284, the clock generator chip. The 8284 will plug into a socket on the Turbo board.

When the switch is set to the normal mode, the computer operates as before; the 8284 uses the 15-MHz pulses of the old crystal installed on the motherboard, for an overall clock speed of 5 MHz. When the turbo mode is selected, the module generates clock pulses at 22.12 MHz for an overall clock speed of 7.37 MHz.

A little trouble

The instructions did not come with any diagrams, so the first thing you should do is get the disassembly instructions that come with either the Z100 User's Manual or the Z100 Technical Manual. These instructions will get you up to the point where you actually install the module on the motherboard.

If you have not taken apart your Z100 before, you should read through the instructions thoroughly before starting. You should also know that installing the module on your computer will probably void your warranty. (But that shouldn't be any problem if you are already past the warranty time—typically, 90 days.)

The first thing to do is get a clear working area so you will have plenty of room to set out the pieces of the computer as you take it apart. Using the diagrams from your manual, you should find the disassembly and assembly fairly straightforward, so I will not bore you with details that are already available to you.

Although the instructions that come with the module recommend you unplug the keyboard, I left it plugged in and experienced no problems installing the

Jeffrey Goldman is a captain in the Air Force, stationed at Luke Air Force Base in Arizona. (As with any Federal employee, his views on speedup modules are not necessarily those of the U.S. Government.)

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Circle #121 on Reader Service Card

```
Program Test(input,output)
 begin
  var b:integer;
   begin
    for b=1 to 200 do
    writeln('AAA...A')
   end.
```

Listing 1. A Pascal routine to test the Turbo unit's speed effect on video-display activities. "AAA...A" in the listing was a series of 60 A's.

	Normal	Turbo	% Decrease
Load	26.6	21.0	26.7
Recalculate	16.7	11.2	32.9
Sort	212	168	20.8
Video display	18.5	12.7	31.6

Table 1. Speed comparisons (in seconds) for ordinary applications on a Z100 at 5 MHz and 7.37 MHz. "Recalculate" was a recalculation of a 25-by-25 PeachCalc spreadsheet. The "Sort" was a sort under Condor-20 of a 1,032-record data base. The "Video Display" was produced by the Pascal routine given in Listing 1.

module.

The point where you have to be careful is unplugging the 8284 clock chip, plugging the high-speed clock unit into the motherboard, and plugging the clock chip back into the module. This is where I ran into problems.

The first time I put them into the motherboard, I did not have the module and clock chip correctly seated. I reassembled the computer and tried to test it, and nothing happened.

I had to disassemble the computer and reinsert the clock module and clock chip into the motherboard. After I had done this, everything worked as advertised.

The whole operation took about 2½ hours, but it would have taken about an hour if I had done it right the first time. Considering my past experience (none), I think anyone could install one of these in a Z100 without too much problem.

A lot of speed

Now that the High Speed Clock Unit is installed, how good is it?

In order to test it, I ran a number of benchmarks. These benchmarks are meant to show you what the increase in clock speed might mean to you in your day-to-day applications.

The three benchmarks I ran were:

1. Speadsheet load and recalculation under PeachCalc. Here, a spreadsheet 25 cells wide by 25 down was set up with the value 1 in the upper left cell, A1; the value in each other cell was 1.001 times the value of an earlier cell. For the recalculation, the number 2 was entered into cell A1, and the stopwatch was started when the manual recalculation key was pressed.

2. Record sort under Condor-20 data base manager. I have a 1,032-record data base of books (29 kilobytes); there are four fields. A sort was done by two fields.

3. A write to the video screen. The program in Listing 1 was written and run under Turbo Pascal.

I chose these benchmarks because they illustrate how different operations will or won't benefit from the full 47% increase in clock speed.

You can see from Table 1 that the spreadsheet recalculation comes closest to giving us the full benefit of the increase in clock speed—because it is a CPU-dependent operation.

PeachCalc recalculates a spreadsheet when it loads it, so we also see a significant increase here.

The sort under Condor resulted in a much smaller increase because Condor did not keep the entire file in memory. Instead, the file was swapped back and forth between memory and temporary disk files. This extensive use of virtual memory causes a lot of disk accesses during a sort. The resulting increase in speed is much smaller but still significant.

Finally, the display for the Z100 is RAM based and dependent upon the clock speed; therefore, there is a significant increase in the speed of the video display. This is most noticeable in scrolling operations in a spreadsheet or word processor.

Although you do not see a full 47% increase in any of the results, I think the increase in speed is significant; now that I have the Turbo module installed, I would not want to go back to the old speed and slower operations of the normal crystal.

Ordering Information

Turbo Z100 High Speed Clock Unit, $39.95 plus shipping and handling.
Del Scientific, Inc.
4919 Musseter Road
Ijamsville, MD 21754
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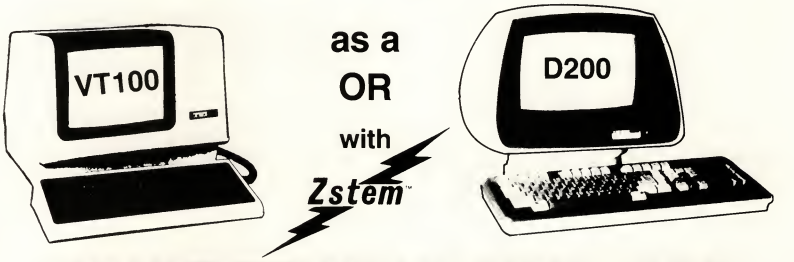

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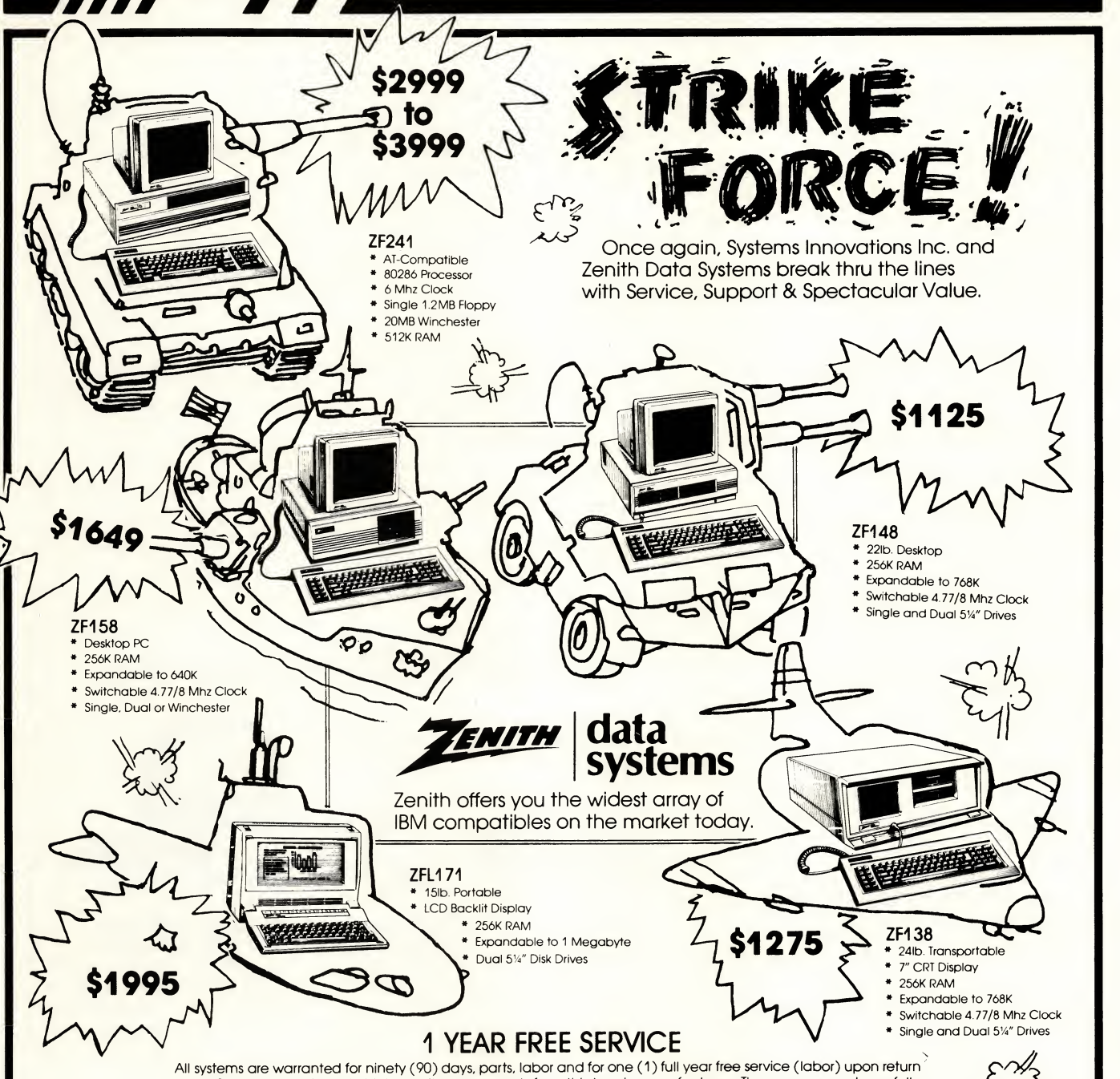

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A Software Clock for HDOS

It's easier to install than a hardware clock, and it can be placed in an out-of-the-way location.

Charles Horn

If you want a real-time clock that will continuously update and display the time on the H/Z89 screen, you must buy a hardware clock, somehow get it wired to an available port with interrupts, and install some kind of software to read it.

Right?

Well, not necessarily.

I set out to see what might be possible with software alone. What I ended up with was SCLOCK, the program shown in Listing 1.

I had a good chance of success—armed with a lot of good work that other people had already done for me. First, there was a device-driver clock routine by Dale Lamm. (See "The HDOS Device Driver Programmer's Guide," by Al Dallas, Dale Lamm, and Tom Jorgenson, in *REMark* #20, September 1981.)

Next, I had Pat Swayne's improvements to Lamm's routine; they cause it to display time continuously on the screen. (See his article "Clock Watcher's Delight," in *REMark* #22, November 1981.)

After that, I gained some ideas from A. E. Dessler and his spooler. (He covered a stripped-down version of his spooler in *Sextant* #6, Summer 1983. See "Inside a Spooler.")

I also got some recent experience working with BYE, Dave Jaffe's public domain communications and bulletin board program. It is self-relocating, so it sizes your available memory and loads itself into memory automatically; the relocation code is by Bill Precht.

Some further help came from Aaron Reynolds and his illuminating discussion of interrupt programming under the Heath Disk Operating System (HDOS). (See "Interrupt Programming Under HDOS" in *Sextant* #4, Winter 1983.)

If you're just starting out, you might want to take a look at the Reynolds article for more of an introduction to interrupt programming. An interrupt signal is a means for a device to get the attention of the central processing unit (CPU). That way the CPU doesn't have to waste its time keeping track of whether the devices have anything to say. As another consideration, properly designed interrupt handling keeps inputs from conflicting with each other or interfering with CPU action.

Charles Horn is General Manager of Horn Engineering Associates and works as an electronics engineer in Texas. He's contributed a number of CP/M utility programs to the public domain, though he's "a firm advocate of the survival of HDOS as a superior operating system."

Do I want the device-driver approach?

I might have been satisfied with Pat Swayne's device-driver implementation. The idea has a lot going for it.

> ***The system never knows that the clock is on the screen.***

HDOS, after all, is designed to talk with peripherals through device drivers. To add a new peripheral, a programmer writes a utility to do the job. Up to seven of these utilities, with the .DVD extension, can be "tacked on" to HDOS at one time. On boot-up, HDOS will look for any files with the .DVD extension. It will load them and allot memory for them. HDOS does the housekeeping; we don't have to.

The problem with Swayne's clock routine is that it does its display task within its intercept routine for processing system-clock interrupts. Unfortunately, his code takes more time to act than allowed for by the clock's two-millisecond interval—which causes loss of the interrupts for the system clock's tick-counter (TICCNT) output. That, in turn, upsets the clock calibration.

He corrected for the upset calibration; but I was disturbed by his interference with HDOS's disk-timer routines—which regulate conversation between the CPU and the drives. When I was using Swayne's clock routine, a noticeable "ticking" noise came from the drive during reads, writes, and resets. I didn't know exactly what was happening, but it didn't sound totally healthy. I would expect this situation to cause write errors.

I set out to solve that problem and to introduce an alternative to the device-driver approach.

Four questions

Before we get carried away with the whole idea of a software clock, I must concede that your time will be lost whenever the system is reset or the power is turned off.

Short of a reset or power-down, though, it should be possible to set the clock at the beginning of a session and expect it to display accurate time until you are done—even over a period of days.

To get started writing a clock program, the questions that we must answer are:

(1) Where can we put a clock routine where it will be out of the way and undisturbed by any normal activities?

(2) How can we install it there?

(3) How can we get to it in order to set it?

(4) Once the clock is started, how can we cause it to update its screen display every second?

. . . and their answers

The first and second of those questions could be easy to answer. We could use Lamm and Swayne's device-driver technique. However, I wanted to experiment with something different.

It is not widely known that a standard H/Z89 CPU board has a couple of empty sockets for static random-access memory (RAM) chips; these are at U522 and U524. When loaded with 2114 RAM chips, they will provide 1 kilobyte of RAM that is available for any use. This memory is in the address range from 020 000 split-octal (A) (1000 hexadecimal) to 023 377A (13FFH), which does not fall within the normal user working area.

If we could plant our small clock routine there, we would not need to go the device-driver route and use up one of our limited number of device-driver allocations. We would also not reduce our available working memory area at all. A device driver with all its memory overhead would reduce the working area by almost 2K, which would prevent execution of some large programs. For example, HUG's "Dungeons and Dragons" would no longer fit.

Now that we have a location, how can we load it there?

My choice was to borrow a trick from BYE—get the assembler to compute the addresses of all labels so that they fall within a target memory range.

You might notice that a major part of Listing 1 contains code with labels of the form LABEL EQU *–OFFSET. This is the actual clock code that will get moved into the target memory area.

The asterisk refers to the address of wherever the assembler is at that point in code. OFFSET is computed by the assembler as the difference between the actual START address of the clock code when first brought into memory (which is unknown to us beforehand) and the DESTination address of the target memory (our 1K memory). The assembler, then, equates label addresses with the actual addresses they should have after re-location.

This simple scheme is possible because the destination address (our 1K memory) is known. In contrast, device drivers are written in HDOS relocatable Position Independent Code (PIC), and HDOS computes these addresses "on the fly" when the driver is loaded. The assembler also computes the number of bytes that are to be moved.

The program thus consists of the clock code itself, attached to a loader that moves it into place after the program is called into the normal program load area (USERFWA) for execution.

This loader checks to see if the clock is already loaded; if not, it moves the clock into place.

The other important task for this loader is to patch several HDOS system-interrupt vectors so that the interrupt-service routines will detour through our clock routine before continuing.

One of these intercepts uses the 2-millisecond TICCNT interrupt to maintain our clock. Another checks keyboard characters as they are struck to detect the

Listing 1. SCLOCK provides a running time display on the H/Z89's screen. Since it is a software clock, the user must set the time at power-up and reset. While it needs no additional circuitry, this clock does require the installation of two 2114 RAM chips in the '89's usually empty U522 and U524 sockets.

```
        TITLE   'SCLOCK; A Front Panel Clock for LOW MEMORY'
        STL     'from HORN ENGINEERING ASSOCIATES'
*
****************************************
****************************************
**        SCLOCK.ABS  Ver 2.0         **
**        Copyright (c) 1984          **
**              by                    **
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****************************************
****************************************
*
LINE25  EQU     0               SET TO 1 FOR UPPER RIGHT DISPLAY
*
***     PROGRAM EQUATES
*
SYS$$   EQU     366156A         F66EH: LOCATION OF .SCOUT IN HDOS
UIVEC1  EQU     040037A         TICCNT INTERRUPT VECTOR JUMP
UIVEC3  EQU     040045A         CONSOLE INTERRUPT VECTOR JUMP
UIVEC7  EQU     040061A         SCALL INTERRUPT VECTOR JUMP
S.HIMEM EQU     040316A         HARDWARE HIGHEST MEMORY ADDRESS
USERFWA EQU     042200A         NORMAL HDOS PROGRAM ENTRY ADDRESS
DEST    EQU     020000A         THE LOW MEMORY START ADDRESS
S.CUSOR EQU     040330A         LOCATION OF CURRENT CURSOR POSITION
NL      EQU     12Q             HDOS NEW-LINE (RETURN)
TAB     EQU     11Q             TAB CHARACTER
BELL    EQU     07Q             BELL CHARACTER
ENTCHR  EQU     'J'-100Q        CTRL-J ENTRY CHARACTER
CAL     EQU     -1-500          CLOCK CALIBRATION FACTOR
$TYPTX  EQU     031136A         ROM SCREEN OUTPUT ROUTINE
$MOVE   EQU     030252A         ROM BLOCK MOVE ROUTINE
$SCOUT  EQU     02Q             SCALL .SCOUT INDEX

        XTEXT   HOSDEF

        ORG     USERFWA

START-  LDA     LDFLG           GET LOAD STATUS FLAG
        DCR     A               1=ALREADY LOADED
        JNZ     RELOC           GO LOAD PROGRAM IF NOT ALREADY LOADED
        LHLD    UIVEC1+1        GET TICCNT VECTOR ADDRESS
        LXI     D,CLOCK         OUR CLOCK INTERRUPT DETOUR ADDRESS
        MOV     A,L             LS BYTE OF TICCNT VECTOR (ONLY LS BYTE CHECKED)
        CMP     E               SEE IF TICCNT VECTOR HAS BEEN PATCHED
        JZ      EXIT1           CLOCK ALREADY LOADED - ABORT
*
*       IF THE STATUS IS LOADED BUT THE UIVEC VECTORS HAVE NOT BEEN
*       PATCHED, THIS CODES ASSUMES A HARDWARE RESET HAS OCCURRED
*       LEAVING THE STATUS FLAG SET BUT THE UIVECS HAVE BEEN RENEWED
*       BY THE NEW BOOT.  WE SIMPLY RESET THE LOAD STATUS FLAG AND
*       LOAD THE PROGRAM ANYWAY.  THIS PREVENTS A HANGUP CONDITION THAT
*       WOULD REQUIRE SOME SORT OF RESET TO PERMIT A LOAD.
*
        XRA     A
        LDA     LDFLG           FLAG AS NOT LOADED
        JMP     RELOC

***     RELOCATION TO LOW MEMORY
*
*       WE MUST FIRST FIND THE ENTRY ADDRESS OF THE .SCOUT SCALL
```

→

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```
*       ROUTINE IN HDOS.  THE SCALL INTERRUPT IS INTERCEPTED BY OUR
*       PROGRAM TO OUTPUT TIME TO THE SCREEN.  WE CAN NOT USE SCALLS
*       DIRECTLY WHILE IN THIS ROUTINE, BUT WE CAN CALL THE .SCOUT
*       PROCESS DIRECTLY IN HDOS IF WE KNOW WHERE IT IS.  THE FOLLOWING
*       CODE COMPUTES THIS LOCATION FOR ANY HARDWARE CONFIGURATION,
*       REGARDLESS OF THE PARTICULAR MACHINE MEMORY SIZE.
*
RELOC   LHLD    S.HIMEM         MAX HARDWARE ADDRESS - 1
        LXI     D,SYS$$+1       OFFSET TO .SCOUT ROUTINE
        DAD     D               COMPUTE LOCATION
        SHLD    SCOUT$+1+OFFSET
*
***     NOW TO RELOCATE
*
        LXI     B,BYTES         NUMBER OF BYTES TO MOVE
        LXI     D,SOURCE        "FROM" ADDRESS
        LXI     H,DEST          "TO" ADDRESS
        CALL    $MOVE           MOVE IT
        JMP     DEST            JUMP TO IT

***     EXIT PROCESSORS
*
EXIT1   CALL    $TYPTX
        DB      NL,TAB,TAB,'CLOCK already loaded...',BELL,NL
        DB      TAB,TAB,'Hit CTRL-J for menu...',NL,NL+200Q

        XRA     A               RETURN NO ERROR
        SCALL   .EXIT

***     RELOCATION EQUATES
*
SOURCE  EQU     *               BOUNDARY MARKER FOR MOVE
OFFSET  EQU     SOURCE-DEST     OFFSET THAT SETS UP LOW MEMORY ADDRESSES
*
*************************************************************************
*                       CAUTION                                         *
*                       -------                                         *
*       ALL LABELS FROM HERE ON MUST BE OF THE FORM "LABEL EQU *-OFFSET"  *
*       SO THAT THE ADDRESSES OF EACH LABEL WILL BE CORRECT AFTER THE     *
*       MOVE TO LOW MEMORY.  THIS TECHNIQUE IS BORROWED FROM THE CP/M     *
*       BYE PROGRAM, AS WRITTEN BY BILL PRECHT.                           *
*                                                                         *
*************************************************************************
*
PSTART  EQU     *-OFFSET
*
*       OUR FIRST BUSINESS IS TO PATCH THE HDOS UIVECS TO DETOUR THROUGH
*       OUR PROGRAM.  THE UIVEC1 INTERRUPT IS USED TO UPDATE OUR CLOCK.
*       THE UIVEC3 INTERRUPT IS USED TO INTERCEPT KEYBOARD INPUTS FOR
*       DETECTION OF THE CTRL-J CLOCK ENTRY CHARACTER.  THE UIVEC7
*       SCALL INTERRUPT IS USED TO CALL THE OUTPUT TO THE SCREEN WHEN
*       A SECOND BOUNDARY FLAG HAS BEEN SET.
*
        DI                      ALLOW NO INTERRUPTS WHILE HERE
        LHLD    UIVEC1+1        GET THE TICCNT JUMP VECTOR
        SHLD    CLKRET+1        INSTALL AT END OF OUR CLOCK ROUTINE
        LXI     H,CLOCK         OUR TICCNT ENTRY ADDRESS
        SHLD    UIVEC1+1        ZAP THE TICCNT VECTOR

        LHLD    UIVEC3+1        GET THE TT JUMP VECTOR
        SHLD    TTVEC+1         INSTALL AT END OF OUR TERMINAL ROUTINE
        LXI     H,TTINT         OUR CONSOLE PROCESS INPUT ADDRESS
        SHLD    UIVEC3+1        ZAP THE TT VECTOR

        LHLD    UIVEC7+1        GET THE SCALL JUMP VECTOR
        SHLD    EXSCAL+1        INSTALL AT END OF OUR SCALL ROUTINE
```

➔

character we have selected to get the clock's attention when we want to set or control it (the answer to question 3).

That leaves us with the last question, how to update the display. Here, I display time to the screen by intercepting the interrupt for calls to HDOS system services (the SYSCALL interrupt). Credit for this idea goes to Dessler.

My choice of a character to access the clock was the control-backslash (CTRL-\), but any selected single character will work if the system does not recognize it for something else. The clock routine recognizes this character when struck, then the clock routine branches to its menu. The menu permits setting the clock, turning it on and off, and unloading the clock from memory (which will also destroy the clock setting).

A note of caution here: if there is any chance that a CTRL-\ might be struck while, for example, you are in an editor or BASIC, it might be advisable for you to unload the clock beforehand. The only exit from the clock menu is to HDOS, which could cause a tragic loss of data.

The intercept routine for the SYSCALL interrupt is particularly useful for our screen display because its operation is not time sensitive; there is no limit to how much time we can use. We need not worry about disrupting anything else the system is doing. Whatever the system is doing, it is probably making frequent use of HDOS SYSCALLs.

The most useful SYSCALL to us is the call for direct input from the console to the CPU (SCIN). This is where the system loops when not doing anything else. (It never just halts.)

However, we use all SYSCALLs—except the call for output from the CPU to the console (SCOUT).

If our clock display to the screen were to interrupt some escape sequence to the screen (such as cursor-control functions from an editor or a graphic game), the

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meaning of the interrupted sequence would be lost. Spurious characters would appear on the screen, with general destruction of the screen display.

Hence, when action passes to our clock display routine, our program reads the SYSCALL's function index—which is passed as a parameter to the processing routine. If it does not call for the SCIN function, we simply bypass the screen update routine. No time is lost, just the current screen update.

I use a special trick to display our clock output.

Swayne sent the output directly to the console port. My choice was to send it directly to the HDOS screen-output service routine. This has the same effect, but with less code to write. It conserves our very limited memory space. Our loaded program can not be larger than 1K.

A way to the screen

Ordinarily, we would send something like our time display to the screen by means of HDOS's SCOUT SYSCALL. In our case, that might be unwise. SYSCALLs are, after all, special subroutines in the form of software interrupts. It is not generally a good practice for a subroutine to call itself without a very good reason. Iterative math routines use this trick (called re-entrance), and they must sometimes use a great amount of stack space in memory to store a return address for each re-entrant call. SYSCALLs are somewhat re-entrant. But why take a chance?

Therefore, we need to gain access to the HDOS SCOUT service routine, without the help of a SYSCALL. We must find it in HDOS, regardless of where the operating system is located in memory. HDOS's location (and therefore SCOUT's) is determined by the size of the memory in your system. We must determine the address offset of the SCOUT routine from some system address that is maintained by the system. My choice was an address called S.HIMEM, which is the value of the highest memory address available. HDOS maintains S.HIMEM at a fixed address, regardless of the size of your memory.

We can find the offset to the SCOUT routine because Heath has been generous enough to make the HDOS source code available.

We then add the SCOUT offset from the beginning of HDOS to the S.HIMEM address; this wraps the result up over the maximum possible address (64K) and back up to the SCOUT routine, regardless of the system size. (CP/M calls such an offset a "negative offset.") Our program patches the resulting HDOS system address into itself so it can go there.

Avoiding losses

There is one other problem that we should protect our clock from. If you should strike a key within the short period of time that the clock's screen output is in progress, HDOS will put the character on

```
        LXI     H,SCST          OUR SCALL ENTRY ADDRESS
        SHLD    UIVEC7+1        ZAP THE SCALL VECTOR
        EI                      ALLOW INTERRUPTS
        MVI     A,1
        STA     LDFLG           FLAG THE PROGRAM LOADED
*
***     THE LOAD IS NOW COMPLETE.  WE CAN LEAVE IT THIS WAY
*       WITH A MESSAGE.
*
        CALL    $TYPTX
        DB      NL,TAB,TAB,'Hit CTRL-J to Start CLOCK',BELL,NL+200Q

EXIT    EQU     *-OFFSET
        CALL    $TYPTX
        DB      NL,TAB,TAB,'+++ Exit to HDOS +++',NL,NL+200Q
        XRA     A               RETURN NO ERROR
        SCALL   .EXIT

************************************
***     INTERRUPT PROCESSORS       ***
************************************

***     THE TT INTERRUPT PROCESS
*
TTINT   EQU     *-OFFSET
        PUSH    PSW             SAVE
        PUSH    B                 ALL
        PUSH    D                   REGI-
        PUSH    H                     STERS
        MVI     A,1             KEYSTROKE FLAG
        STA     KEYFLG          FLAG THAT A KEYSTROKE HAPPENED
        IN      350Q            GET KEYBOARD ENTRY
        CPI     ENTCHR          CTRL-J?
        JZ      ENTRY           DISPLAY MENU IF SO
        POP     H               RESTORE
        POP     D                 ALL
        POP     B                   REGI-
        POP     PSW                   STERS
TTVEC   EQU     *-OFFSET
        JMP     *               THE UIVEC1 VECTOR IS PATCHED HERE WHEN LOADED

ENTRY   EQU     *-OFFSET
        SCALL   .CLRCO          CLEAR CONSOLE

MENU    EQU     *-OFFSET
        CALL    $TYPTX
        DB      33Q,'E',NL      CLS
        DB      TAB,TAB,'CLOCK for LOW MEMORY from',NL
        DB      TAB,TAB,'Horn Engineering Associates',NL+200Q

MENU1   EQU     *-OFFSET
        CALL    $TYPTX
        DB      NL,TAB,TAB,'Select Function - then Hit RETURN',NL,NL
        DB      TAB,TAB,'T = Display Time',NL
        DB      TAB,TAB,'S = Set Time',NL
        DB      TAB,TAB,'D = Disable Time Display',NL
        DB      TAB,TAB,'U = Unload CLOCK from memory',BELL,NL,NL,TAB,TAB+200Q
        XRA     A
MENU2   EQU     *-OFFSET
        SCALL   .SCIN
        JC      MENU2           WAIT FOR ENTRY
        CPI     ' '
        JZ      MENU2           IGNORE SPACES
        ANI     05FH            MAKE UPPER CASE
        CPI     'T'
        JZ      READ            DISPLAY TIME
        CPI     'S'
        JZ      WRITE           SET TIME
        CPI     'D'
        JZ      DISABL          DISABLE CLOCK
        CPI     'U'
        JZ      UNLOAD          UNLOAD CLOCK
        CALL    $TYPTX
        DB      33Q,'E',NL+200Q CLS
        JMP     MENU1           GET IT RIGHT

WRITE   EQU     *-OFFSET
        SCALL   .CLRCO          CLEAR CONSOLE
        CALL    $TYPTX
        DB      33Q,'E',NL      CLS
        DB      TAB,TAB,'Enter Time - Then Hit RETURN',NL,NL
        DB      TAB,TAB,'Format = HH:MM:SS',NL,NL,TAB,TAB+200Q

TIMENT  EQU     *-OFFSET
        LXI     H,TEMPBUF       POINT TO TEMPORARY BUFFER
        MVI     C,8             ALLOW ONLY 8 CHARACTERS

TIMENT1 EQU     *-OFFSET
        SCALL   .SCIN
        JC      TIMENT1         WAIT FOR ENTRY
        CPI     ' '
        JZ      TIMENT1         IGNORE SPACES
        CPI     NL
        JZ      TIMENT          INSIST ON PROPER ENTRY
        MOV     M,A             PUT CHARACTER IN BUFFER
        INX     H               BUMP BUFFER POINTER
        DCR     C               REDUCE COUNT
        JZ      WRITE1          IF DONE
        JMP     TIMENT1         GO GET SOME MORE

WRITE1  EQU     *-OFFSET
        SCALL   .CLRCO          CLEAR CONSOLE
```

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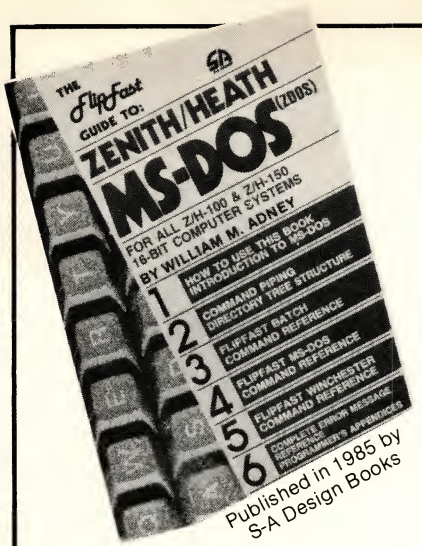
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```
        LXI     D,TEMPBUF       SOURCE FOR MOVE
        LXI     H,TIMEBUF+2     DESTINATION FOR MOVE
        LXI     B,8             8 CHARACTERS TO MOVE
        DI                      NO INTERRUPTS TO MESS THIS UP
        CALL    $MOVE           MOVE TIME INTO READ BUFFER
        EI

***     FALL THROUGH HERE TO ENABLE THE DISPLAY WHEN TIME HAS BEEN SET
*
READ    EQU     *-OFFSET
        SCALL   .CLRCO          CLEAR THE CONSOLE
        MVI     A,1             SET DISPLAY ACTIVE
        STA     DFLAG           STORE IT
        JMP     EXIT

DISABL  EQU     *-OFFSET
        SCALL   .CLRCO          CLEAR CONSOLE
        XRA     A               FLAG FOR
        STA     DFLAG             NO DISPLAY
        CALL    $TYPTX
        DB      33Q,'y1',NL+200Q        DISABLE 25TH LINE
        JMP     EXIT

UNLOAD  EQU     *-OFFSET
        SCALL   .CLRCO          CLEAR CONSOLE
        XRA     A
        STA     LDFLG           ZERO THE LOADED STATUS FLAG
        DI
        LHLD    CLKRET+1        GET HDOS TICCNT VECTOR
        SHLD    UIVEC1+1        RESTORE IT
        LHLD    TTVEC+1         GET HDOS CONSOLE VECTOR
        SHLD    UIVEC3+1        RESTORE IT
        LHLD    EXSCAL+1        GET HDOS SCALL VECTOR
        SHLD    UIVEC7+1        RESTORE IT
        EI
        CALL    $TYPTX
        DB      33Q,'y1',NL     DISABLE 25TH LINE
        DB      TAB,TAB,'CLOCK Unloaded from Memory...',NL,NL+200Q
        JMP     EXIT

***     THE SCALL INTERRUPT ROUTINE TO DISPLAY TIME
*
SCST    EQU     *-OFFSET
        STA     PARAM           SAVE SCALL PASSED PARAMETER
        XTHL                    POINT HL TO SCALL INDEX
        MOV     A,M             GET THE INDEX
        XTHL                    RESTORE HL AND STACK
        STA     INDEX           SAVE THE INDEX
        LDA     PARAM           PSW NOW BACK TO ORIGINAL
        PUSH    PSW             SAVE
        PUSH    B                 ALL
        PUSH    D                   REGI-
        PUSH    H                     STERS
        LDA     INDEX           GET THE SCALL INDEX
        CPI     $SCOUT          IS IT THE .SCOUT SCALL?
        JZ      SCEXIT          BAIL OUT IF SO TO PREVENT INTERFERENCE

        LDA     SHOWFLG         1 = TIME TO DISPLAY
        DCR     A
        JNZ     SCEXIT          BAIL OUT - NOT TIME
        STA     SHOWFLG         RESET SHOW FLAG

        LDA     KEYFLG          1 = KEY STRUCK
        DCR     A
        STA     KEYFLG          ASSUME KEYFLG SHOULD BE RESET
        JZ      SCEXIT          KEY STRUCK - NO DISPLAY
        XRA     A
        STA     KEYFLG          RESET KEYSTROKE FLAG

        LDA     DFLAG           1 = DISPLAY ENABLED
        DCR     A
        JNZ     SCEXIT          BAIL OUT

        LXI     H,DISPLAY       THE TIME DISPLAY BUFFER

        CALL    SCOUT

SCEXIT  EQU     *-OFFSET
        POP     H               RESTORE
        POP     D                 ALL
        POP     B                   REGI-
        POP     PSW                   STERS

EXSCAL  EQU     *-OFFSET
        JMP     *               UIVEC7 VECTOR PATCHED HERE WHEN LOADED

SCOUT   EQU     *-OFFSET
        MVI     A,1
        STA     S.CUSOR         FORCE CURSOR REPORT TO COLUMN 1
        MOV     A,M

SCOUT$  EQU     *-OFFSET
        CALL    *               THE .SCOUT SCALL ROUTINE IN HDOS

        ANI     200Q
        RNZ
        INX     H
        JMP     SCOUT

***     THE CLOCK INTERRUPT ROUTINE
*
CLOCK   EQU     *-OFFSET
```

```
        PUSH    PSW             SAVE
        PUSH    B                 ALL
        PUSH    D                   REGI-
        PUSH    H                     STERS
        LHLD    TICKS           GET OUR PRIVATE TICK COUNT
        INX     H               BUMP IT
        SHLD    TICKS           PUT IT BACK
        LXI     B,CAL           GET CAL FACTOR
        DAD     B               WILL CAUSE A CY IF "TICKS" = 1 SEC
        JNC     CLKRET2         NOT TIME TO CONTINUE
        DI
        SHLD    TICKS           (HL) WAS ZERO - RESET TICK COUNT
        MVI     C,'Ø'           ASCII ZERO

INRS    EQU     *-OFFSET
        LXI     H,TIMEBUF+9     POINT TO LS SECOND POSITION
        INR     M               BUMP IT
        MOV     A,M             GET IT
        CPI     '9'+1           OVERFLOW?
        JM      CLKRET1         NO - RETURN
        MOV     M,C             SET LS SECOND TO 'Ø'

INRTS   EQU     *-OFFSET
        DCX     H               POINT TO TENS SECONDS
        INR     M               BUMP IT
        MOV     A,M             GET IT
        CPI     '6'             OVERFLOW?
        JM      CLKRET1         NO - RETURN
        MOV     M,C             SET MS SECOND TO 'Ø'

INRM    EQU     *-OFFSET
        DCX     H               POINT BACK OVER COLON
        DCX     H                 TO LS MINUTE
        INR     M               BUMP IT
        MOV     A,M             GET IT
        CPI     '9'+1           OVERFLOW?
        JM      CLKRET1         NO - RETURN
        MOV     M,C             SET LS MINUTE TO 'Ø'

INRTM   EQU     *-OFFSET
        DCX     H               POINT TO MS MINUTE
        INR     M               BUMP IT
        MOV     A,M             GET IT
        CPI     '6'             OVERFLOW?
        JM      CLKRET1         NO - RETURN
        MOV     M,C             SET MS MINUTE TO 'Ø'

INRH    EQU     *-OFFSET
        DCX     H               POINT BACK OVER COLON
        DCX     H                 TO LS HOUR
        INR     M               BUMP IT
        MOV     A,M             GET IT
        CPI     '4'             OVERFLOW?
        JM      CLKRET1         NO - RETURN

INRH1   EQU     *-OFFSET
        DCX     H               POINT TO MS HOURS
        MOV     A,M             GET IT
        CPI     '2'             IS IT 24 AND NOT 14 OR Ø4?
        JM      INRH2           MORE CHECKING TO DO
        MOV     M,C             SET MS HOURS TO 'Ø'
        INX     H               POINT BACK TO LS HOURS
        MOV     M,C             SET LS HOURS TO 'Ø'
        JMP     CLKRET1         (IT WAS MIDNIGHT)

INRH2   EQU     *-OFFSET
        INX     H               POINT BACK TO LS HOURS
        MOV     A,M             GET IT
        CPI     '9'+1           OVERFLOW?
        JM      CLKRET1         NO - RETURN
        MOV     M,C             SET LS HOURS TO 'Ø'

INRTH   EQU     *-OFFSET
        DCX     H               POINT TO MS HOURS
        INR     M               BUMP IT

CLKRET1 EQU     *-OFFSET
        MVI     A,1
        STA     SHOWFLG         SET TIME TO DISPLAY FLAG

CLKRET2 EQU     *-OFFSET
        POP     H               RESTORE
        POP     D                 ALL
        POP     B                   REGI-
        POP     PSW                   STERS

CLKRET  EQU     *-OFFSET
        JMP     *               UIVEC7 PATCHED HERE WHEN LOADED

**********************
*** PROGRAM STORAGE ***
**********************
*
DFLAG   EQU     *-OFFSET
        DB      Ø               DISPLAY ACTIVE FLAG; 1 = ACTIVE

LDFLG   EQU     *-OFFSET
        DB      Ø               LOADED STATUS FLAG; 1 = PROGRAM LOADED

        SHOWFLG EQU     *-OFFSET
                DB      Ø               1 = TIME TO DISPLAY TIME
```

→

the screen, but not where you want it to go. It will appear in the time display instead. I solve this problem by disabling and enabling the keyboard within the clock display sequence.

The problem then becomes one of frequent character loss when typing text.

To prevent the loss of typed characters, I set a flag every time the keyboard intercept detects a keystroke. The display routine then detects this flag, aborts the display, and resets the flag. In this way, the display is never updated if a keystroke has occurred since the last update. These provisions completely protect the clock display.

Only a very rare tendency remains for keystrokes to be ignored. For example, this entire text was typed with the clock display active. No more than four keystrokes were noticed to have been ignored, including the few sluggish keys that my keyboard is known to have.

A choice for display

The source code includes an option that enables you to assemble the program with the clock display either near the right end of the 25th line or at the upper right corner of the screen. The 25th line display would be chosen in order to give minimum interference with the Video Scribe editor from Newline Software, but it could be placed anywhere on the line. For example, the output string might be altered to place the display near the center column for the PIE editor from The Software Toolworks.

Be aware that if the display is placed on the top line by the assembly option, an image of the display will appear to scroll with text in an editor when scrolling backward. Even though this is a nuisance, never fear. It will *not* be incorporated into the edited text. The system never knows that it is on the screen. And the time will appear in the correct place when it is updated.

Some points on the program

The real purpose of this article is to demonstrate several unusual programming tricks and the potential uses of interrupt routines. Some of these tricks came from others, and credit is given. I discovered others by sheer determination.

You can check Listing 1, SCLOCK.ASM, for the source code for our clock. The program is heavily commented and should be easy to follow. It contains three major parts:

(1) The header EQUates: These contain essential information that the assembler will need. Notice that an XTEXT file called HOSDEF.ACM (which comes with HDOS) must be present when the program is assembled.

(2) The clock loader: This moves the clock module into the target memory area, then jumps to it to execute the patches to the interrupt vectors.

(3) The clock module itself.

The clock module contains several sep-

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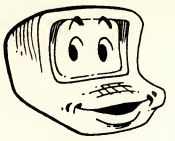

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```
TICKS   EQU     *-OFFSET
        DW      Ø               OUR PRIVATE TICK COUNTER

KEYFLG  EQU     *-OFFSET
        DB      Ø               1 = KEY STRUCK
*
***     THE FOLLOWING 25TH LINE SEQUENCE IS AS FOLLOWS:
*       SAVE CURRENT CURSOR POSITION;
*       CURSOR OFF; DISABLE KEYBOARD; ENABLE 25TH LINE;
*       DIRECT CURSOR ADDRESSING, LINE 25, COL 69;
*       ENTER INVERSE VIDEO MODE; THE ASCII TIME VALUE;
*       EXIT INVERSE VIDEO MODE; ENABLE KEYBOARD;
*       REPLACE PREVIOUSLY SAVED CURSOR POSITION; CURSOR ON
*
DISPLAY EQU     *-OFFSET        THE TIME DISPLAY BUFFER
    IF LINE25
        DB      33Q,'j',33Q,'x5',33Q,'}'
        DB      33Q,'x1',33Q,'Y',56,1ØØ
TIMEBUF EQU     *-OFFSET
        DB      33Q,'p','HH:MM:SS',33Q,'q'
        DB      33Q,'{',33Q,'k',33Q,'y','5'+2ØØQ
    ELSE
***     THIS ALTERNATE SEQUENCE DELETES THE 25TH LINE SEQUENCE AND
*       PLACES THE TIME DISPLAY AT THE UPPER RIGHT CORNER OF THE
*       SCREEN.
*
        DB      33Q,'j',33Q,'x5',33Q,'}'
        DB      33Q,'Y',31,1Ø4
TIMEBUF EQU     *-OFFSET
        DB      33Q,'p','HH:MM:SS',33Q,'q'
        DB      33Q,'{',33Q,'k',33Q,'y','5'+2ØØQ
    ENDIF

TEMPBUF EQU     *-OFFSET
        DB      'HH:MM:SS'

COPR    EQU     *-OFFSET
        DB      'Copr(c) 1984, Horn Engineering Associates'

PARAM   EQU     *-OFFSET
        DS      1               SCALL PASSED PARAMETER
INDEX   EQU     *-OFFSET
        DS      1               SCALL FUNCTION INDEX

PEND    EQU     *-OFFSET        END MARKER FOR CODE TO BE MOVED
BYTES   EQU     PEND-PSTART+1   NUMBER OF BYTES TO BE MOVED TO LOW MEMORY

        END     START
```

arate interrupt intercept routines:

(1) A console interrupt intercept: This is used to detect entry of the attention character from the keyboard, service the maintenance menu, and flag keystrokes.

(2) A SYSCALL interrupt intercept: This is used to display the time when a flag has been set in the system clock intercept to do so.

(3) A system clock interrupt intercept (the 2-ms TICCNT): This is used to maintain our time clock.

Remember, once the clock menu is called by entry of the special keyboard character, the only possible exit is to HDOS. I will leave to the next student of HDOS the challenge of discovering a reliable way to exit back to the point from which we came (editor, video games, etc.).

True, the clock could more easily have been written as a device driver, which would have provided relocation and program protection without our help. However, I chose to add an inexpensive memory enhancement to the '89, then write useful software utilities that can reside there without occupying valuable RAM space.

Do you have the space?

If you want to make this job a bit easier, I may be able to help. My company, Horn Engineering Associates, offers a 1K HDOS Low-Memory Kit, complete with two 2114 RAM chips and installation instructions. It costs $19.95 and comes with a 5¼" single-sided, single-density diskette of useful low-memory utility programs, including SCLOCK, a print spooler, and several others. Of course, only one of these programs can be loaded into the 1K memory at any given time.

As a final note, be aware that this clock is designed to work with HDOS version 2 as distributed. (It is reported that HDOS version 3 will be able to use the entire 64K possible address space, denying it to SCLOCK.) Several non-Heath enhancement read-only memory (ROM) chips are available, and they might not permit access to the 1K low-memory area by the user.

The standard MTR-88/89 ROMs occupy only 2K of memory and are always resident as ROM. And RAM occupies the address space from 4K to 64K.

Some of these other products, however, occupy 4K of memory. And some remap RAM in order to increase available memory. Any ROM vendor should be willing to answer questions about whether they use the memory area in question.

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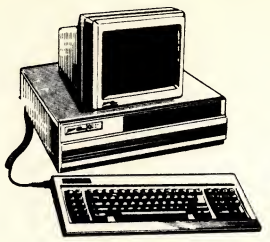

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Upgrade an Internal Modem for Your '100

Some hardware and software modifications bring the U.S. Robotics S-100 modem up to snuff.

Charles Layman

The U.S. Robotics S-100 modem is a 300/1200-baud modem that has been designed to be plugged into any computer having a standard S-100 bus. This offers the advantage of not having a separate piece of equipment to be concerned with. This design also eliminates the cables and power pack. The space savings goes without saying. Thus we have an integrated response to a variety of conditions. (I won't say problems because nothing is a problem unless you perceive it to be so.)

Since Heath/Zenith's H/Z100 computers offer a standard S-100 bus, the marriage of these computers and the U.S. Robotics S-100 modem is inevitable. And it makes a mighty fine match-up! In this article, I wish to discuss some of the findings I made during the wedding ceremony.

On the whole, I am very satisfied with the operation of the U.S. Robotics modem. As you'll see, however, it's not perfect. In fact, a large part of my current satisfaction comes from having gotten around some of its limitations.

Hayes compatibility

The U.S. Robotics modem is of the "smart" variety. That means that it can read the incoming data stream for commands to itself instead of just passing it along. So you can give it commands from the keyboard of your terminal (or computer with a terminal-emulator program). And there are quite a few command sequences you can use with this modem.

The really nice feature of this modem is that the list of commands is a subset of those for the Hayes modem. The Hayes has become a de facto standard, and its commands are the ones most often implemented in modem software. The command structure includes all of the important commands from the Hayes repertoire.

However, where the Hayes allows you to tailor some of the built-in delays, the U.S. Robotics modem uses the fixed default values of the Hayes.

A good example would be the Hayes "," command. The "," inserted into a command string is used to tell the modem to pause for two seconds before continuing to the next command. With the Hayes modem, this two-second value is the default value; it may be easily changed using the S8=n command.

The S8=n command doesn't exist on the U.S. Robotics modem. I don't consider it that important, though, since the two-second default value is adequate for my needs.

There is not a lot of software available to operate it.

You can change some of the other delays, however. For instance, the length of time the modem will wait for the other computer's carrier frequency can be changed. This can be useful if the dial/connect process takes a long time, such as on international calls.

There is one Hayes command which is missing in this modem that I feel is important. The ";" command in the Hayes world allows you to go back to the command state after dialing and connecting. You can do so without going "off hook," that is, without disconnecting. This lets you send touch-tones if further signalling is needed past an initial connection.

It also lets you modify the modem if it is not configured properly. For instance, you can switch from communication in only one direction at a time (half-duplex operation) to communication both ways simultaneously (full-duplex) and then go back to communicating.

However, the U.S. Robotics S-100 modem does have a secondary off-hook control using the Data Terminal Ready (DTR) signal from its 8251A. This control can be implemented to do pretty much the same thing as the Hayes ";" command.

The trick here is to make a connection in the normal fashion. Next send a zero to your modem's DTR bit; this will cause a secondary hold on the off-hook relay. So the other computer will appear on-hook. As far as your modem is concerned, you can now go back to a logical on-hook condition and issue commands to it.

All in all, the command subset chosen makes good sense.

Hardware

The modem comes completely built on a double-sided printed-circuit board. Unfortunately, the general workmanship and artwork for the printed circuitry are not of the best quality; certainly not up to the standards I have grown accustomed to in the Heath/Zenith world.

The printed-circuit line widths varied, and the corner and mating transitions were not smooth. However, other than from a purely aesthetic point of view, there were no problems with the artwork.

The modem is completely self-contained in that it needs no external connection, save the telephone line itself. It derives power and all necessary signals from the S-100 bus.

The telephone connection is made to the modem through an on-board standard RJ11C modular telephone jack. The telephone line can be snaked through one of the slots in the rear panel (more on this later) without causing any harm.

The right-hand half of the modem board is essentially the same package that U.S. Robotics provides in their Password Modem. (This is a very reasonably priced stand-alone smart modem. Both

Charles Layman works as a department manager for GTE Government Systems in Needham, Massachusetts. He's designed several computers, including a fully compatible 8085 version of the H8.

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Dip Switch Segment	4	3	2	1
Corresponding Address	A7	A6	A5	A4

Table 1. On-board port selection is controlled by a slide switch corresponding to address lines 1-3 and by a four-segment DIP switch corresponding to address lines 4-7 as indicated here. See Table 2 for a sample setting with resulting port number.

Dip Switch Segment	4	3	2	1
Corresponding Setting	On	Off	On	Off
Slide Switch	Up			

Table 2. Based on the correspondences indicated in Table 1, these switch settings would select port number A0 hexadecimal (10100000 binary). The least significant digit, address line 0, is used by the USART to discriminate between data (0) and control information (1). Changing the slide switch to down would select port number AE hex (10101110 binary).

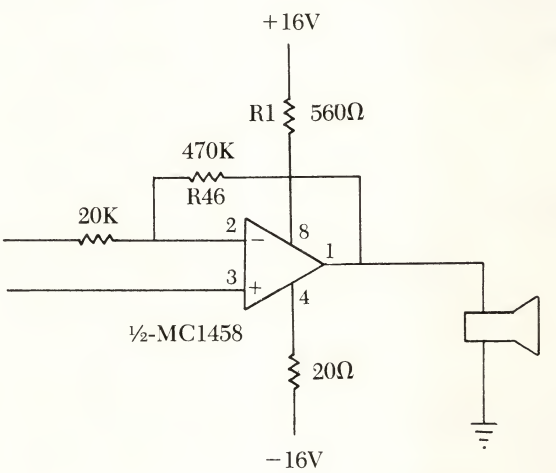

Figure 1. The original audio circuit of the U.S. Robotics S-100 modem.

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11. Robert B. Thorne, **Z-BASIC's CIRCLE Does More Than Draw Circles**, p. 102.

modems retail at $449. A reasonable search of the mail-order houses, however, shows that they are available for closer to $300 apiece.)

This circuitry contains, among other things, two Intel microprocessors: the 8049 and the 8749 (its brother, which has some eraseable programmable read-only memory—EPROM). These make great controllers, but the real heart of the modem is the Intel 2921 Analog Signal Processor.

The 2921 processor combines on-board analog-to-digital and digital-to-analog conversions to provide real-time digital processing of analog signals. This offers the accuracy and stability associated with digital signal processing. Intel 2912 line filters also contribute to the overall quality of the design.

The left-hand side of the board contains the modem's interface to the user and to the system. The interface to the user is through a miniature speaker and amplifier. The audio signal is tapped off the telephone circuitry on the right hand side of the board. This allows you to listen to the modem signalling if you desire.

The interface to the computer system is handled through the standard S-100 bus signals. The data lines are buffered to a parallel-to-serial converter. (Keep in mind that a modem is a serial device to and from the telephone line; but data to and from the bus is parallel.)

The most common converter type (and the one most often used with RS-232 ports) has a number of variants: the asynchronous communications element (ACE), the universal asynchronous receiver/transmitter (UART), and the universal synchronous/asynchronous receiver/transmitter (USART). The U.S. Robotics board uses the Intel 8251A Programmable Communication Interface, a USART.

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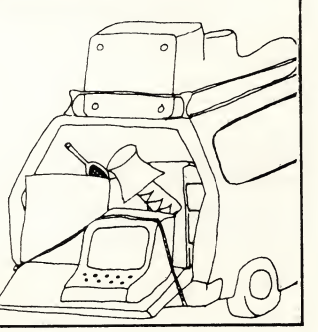

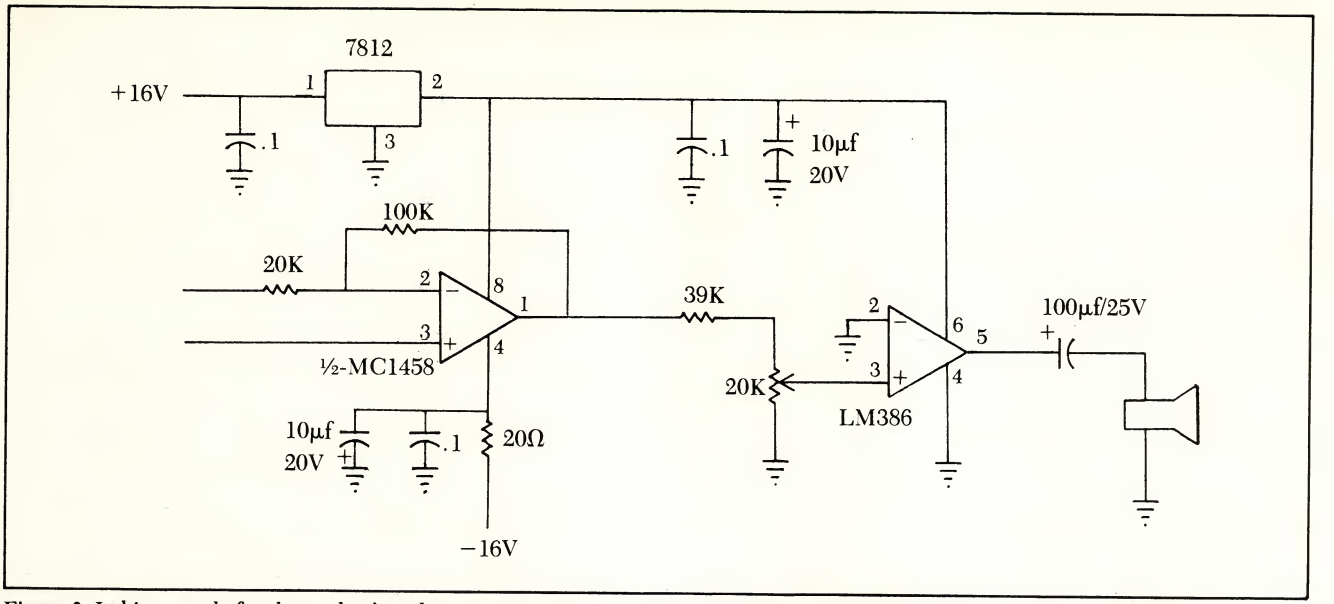

Figure 2. In his upgrade for the modem's audio circuit, the author changed three components and added nine more. (See Figure 1 for the original circuit.)

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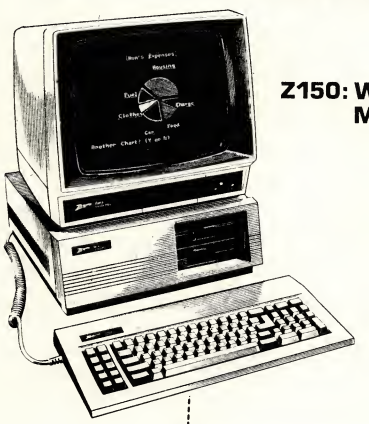

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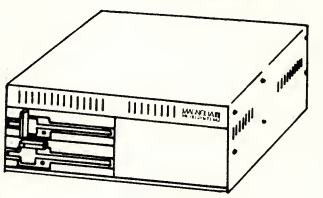

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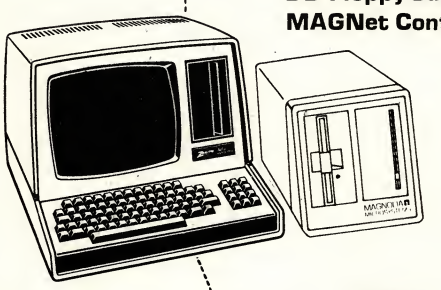

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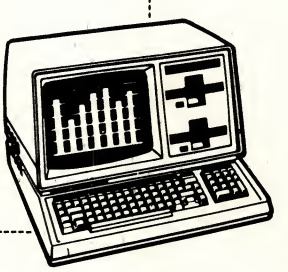

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tion, you set a DIP switch and a slide switch which together correspond to seven of the eight available address lines to the computer. The single-pole slide switch corresponds to lines 1-3 simultaneously. The DIP switch has four segments, and corresponds to address lines as shown in Table 1.

Using the DIP switches and slide switch, you can choose among 32 possible port numbers.

The USART uses address line 0 to discriminate between data (0) and control information (1). Thus when a port has been selected as the data port, the next port address higher will be the control/status port.

Only two ports are required by this USART. With these switch controls, you should be able to select a port address that is not otherwise used in the computer.

If you wanted to select port number A0 (in hexadecimal—10100000 in binary), the switch settings in Table 2 would be appropriate.

Port AE hex (10101110 binary) would have the same DIP-switch settings, but now the slide switch would be in the down position. (With this arrangement of switches, you can select port numbers 00, 10, 20, etc., through F0 hex, or 0E, 1E, 2E, etc., through FE hex.)

The modem's USART has two lines that can be used to generate computer interrupts if desired. These lines carry the TxRDY and the RxRDY signals, signifying Transmitter Ready and Receiver Ready respectively. These lines are brought out to the general vicinity of the S-100 bus interrupt pins.

The S-100 bus requires open-collector low-active level signals to drive these interrupts. The USART, though, supplies standard pulled-up high-active level signals.

This was apparently an oversight on

the part of U.S. Robotics, since they have made a change in this area. They literally glued two 2N3904 transistors (using messy rubber sealant) and wired them in place with the collectors unconnected.

The transistors provide open-collector operation as well as the required signal inversion. It is up to the user to determine which interrupt lines the collectors should be tied to.

The workmanship here leaves something to be desired. And there is not a word on this circuit anywhere in the documentation that comes with the modem.

While on the subject of shoddy workmanship, I should point out that there are two crystals that are mounted perpendicular to the circuit board. One of these, X1, stands higher than just about everything else on the board; certainly higher than anything in the immediate vicinity. Naturally, I managed to bump this crystal and caused it to loosen in its case.

It still works, but I did reinforce the mounting with a good glob of epoxy. Crystals should be mounted parallel to the circuit board whenever possible to prevent this sort of thing. And there certainly was room for parallel mounting in this case.

Audio design improvements

As indicated above, the modem includes an amplifier and speaker connected to the telephone interface so that the user may listen to the audio signalling.

The speaker is a small button type that does not offer very good sound. Even worse, the amplifier is an MC1458 operational amplifier; it is designed merely for high gain, not power or fidelity. This combination of speaker size and amplifier type gives a very distorted sound that is difficult to hear when the modem is installed inside the computer.

The U.S. Robotics audio circuit is shown in Figure 1. This area of design is marginal, at best. I decided to add both increased power and a better speaker.

The audio design can easily be improved by making some minor modifications to the board. By changing three components and adding nine more, the sound quality is improved to the point where it is hard to beat. And you have full control over the volume.

The modified circuitry is shown in Figure 2. There is plenty of room on the board for these changes; they are not all that difficult to make.

There are certainly many ways that a design can be arrived at. All may accomplish the same results. If you ask a dozen designers to develop this circuit, you will end up with a dozen different designs—all of which could be technically correct. I will walk through the changes that I made and describe the

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If you have any questions about any of the information above, please contact us.

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whys and wherefores of each change.

Just to sketch those changes: 1) a higher powered amplifier will be added; this will include adding a speaker coupling capacitor, a volume control, and a dividing resistor; 2) the old speaker will be replaced with a new one; 3) the gain control resistor on the op-amp will be reduced; 4) the power-supply dropping resistor will be replaced by a regulator; and 5) power-supply filtering will be added.

A new audio-amplifier design

The first thing is to add a real audio-amplifier device to the board. The National LM386 is as good as there is when it comes to a simple audio amplifier. This integrated-circuit (IC) chip is an eight-pin DIP device, which makes it easy to mount to the board.

Figure 3 shows the parts placement of the added LM386 amplifier, the speaker's coupling capacitor, the volume control, and the signal-divider resistor.

The volume control can be just about any small trimmer potentiometer that has a value in the vicinity of 20 kilohms. Once the volume level is set to something comfortable, you probably would not want to change it often; so you can get by without an external volume control.

The capacitor can be anything around 100 microfarads, rated at 15 volts or more. This is not critical at all. Use something physically small enough to fit on the board.

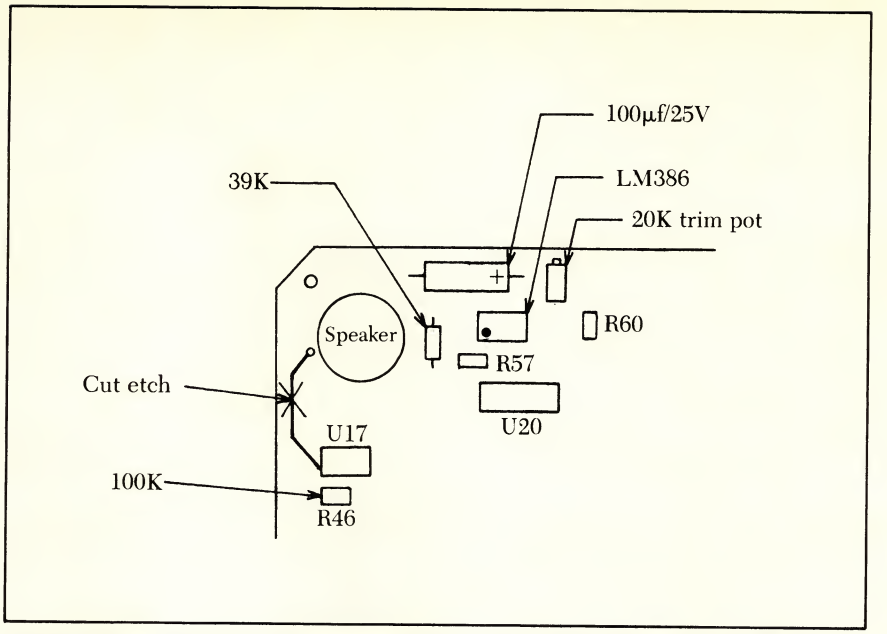

Figure 3. Placement of new audio parts on the front side of the U.S. Robotics S-100 modem board. (See Figure 4 for wiring on the back of the board.)

The resistor can be any value around 39 Kohms. It should be ⅛ to ¼ watt. In combination with the potentiometer (volume control), this resistor acts as a voltage divider to reduce the signal level. This increases the useable portion of the volume-control range.

The audio amplifier connects to the original audio source IC (MC1458), and gives us much more power to the speaker. This allows the insertion of a potentiometer to control the volume. There will be plenty of volume to hear the telephone signalling in the next room, if need be.

Constructing the amplifier

Very carefully mark and drill eight holes for the LM386. The measure-

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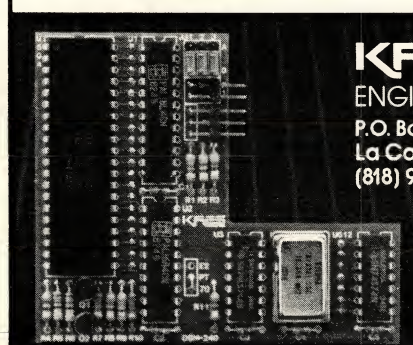

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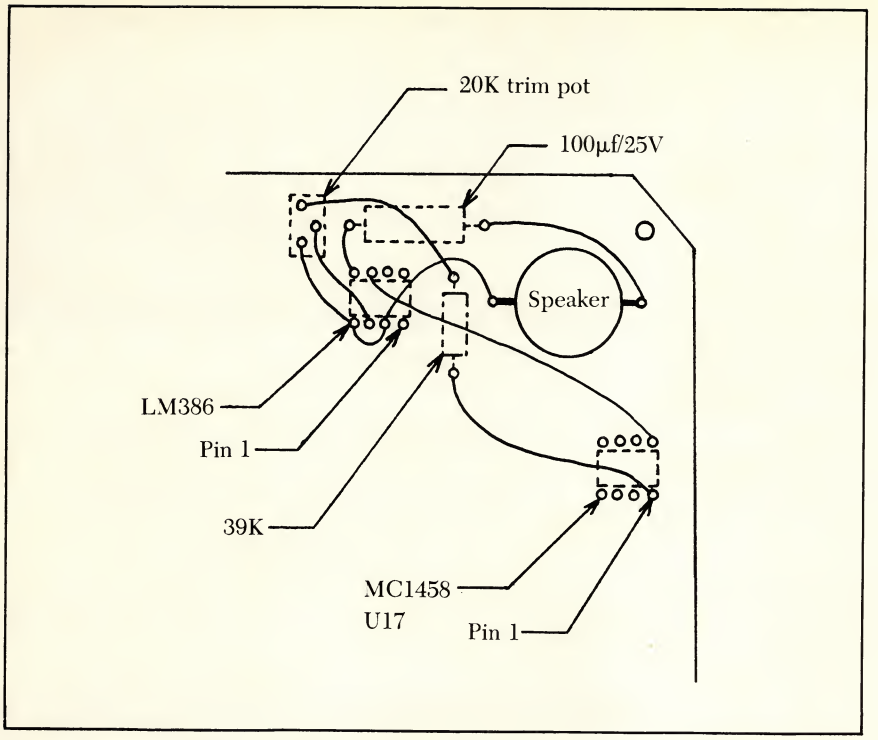

Figure 4. Wiring on the back of the modem board for the author's upgrade to the board's audio circuit. (See Figure 3 for component layout on the front of the board.)

ments are for a standard eight-pin IC chip. Use around a #50 drill bit. I drilled all holes by hand, using a pin vise to hold the drill bit. (A hand or electric drill will also work well.) It's not much work to do this.

First, check the back of the board to make sure that the hole pattern will fall between the two circuit lines present on the board. The capacitor and volume control are to be mounted near the top edge; drill the same #50-size holes for their respective leads.

Mount the capacitor with the plus side to the right. The resistor is mounted between the two circuit lines on the top of the board as shown in Figure 3. A small dab of epoxy will hold each of the components in place.

The wiring of the components is shown in Figure 4. Most of this wiring is done on the back side of the board using #30 wire-wrap wire.

The positive lead from the capacitor is bent over, a piece of tubing is slipped over the lead, and then the lead is soldered to pin 5 of the LM386 amplifier. The resistor lead toward the top of the board is bent over, a piece of tubing is slipped over the lead, and then the lead is soldered to the top pin of the volume control.

Connect a new speaker

In order to connect the speaker to the output of the new amplifier, it is necessary to cut a circuit line on the top side of the board. The outermost line should be cut somewhere near the speaker pad. (See Figure 3.) Make sure there is no continuity through the cut.

When I first tested the new amplifier, I found the old speaker not to my liking. So I replaced it with a new one. The new speaker is a Calectro #S2-214.

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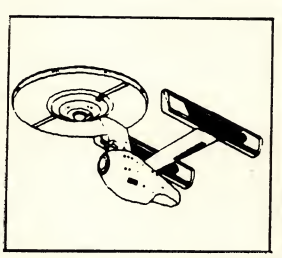

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eight-ohm speaker that is available in most electronics supply stores. It fits in the hole that the old speaker came out of.

Carefully peel away the rubber sealant that holds the old speaker in place. And scrape the board well to get rid of any residue. The new speaker can easily be epoxied in place. Solder bus wire from the new speaker terminals to the pads on the top of the board that the old speaker was soldered to.

Change some resistors

One more change should be made to the audio circuitry: change the feedback resistor on the MC1458 op-amp.

Remove the 470-Kohm resistor at R46 and replace it with a 100-Kohm resistor. (See Figure 3 again.) This will cut the gain down by a factor of about 5—since it would otherwise be too much with the extra amplifier.

To get its power, the MC1458 op-amp used raw 16 volts from the S-100 bus. The 16 volts is dropped to 12 volts through a 560-ohm resistor. (See Figure 2.) This is not the ideal method of supplying power to an amplifier of any consequence. The stronger the input signal, the more current is drawn from the power supply, and therefore the more voltage is dropped across the resistor. The result is a great deal of distortion at the speaker.

The simplest solution is to remove the 560-ohm resistor and replace it with an MC7812 12-volt regulator. The –16 volts is dropped to –12 volts through a 20-ohm resistor. It is used only by the MC1458 and not enough current is drawn to affect the audio sound, so it can be left alone.

Since the +16 volts is only used to power the audio circuits, making changes to this circuitry creates no problems elsewhere.

Figure 5 shows the location of R1, the 560-ohm resistor. Remove this resistor. Take an MC7812 (one with a TO-220 case) and bend the middle lead backwards. The two outer leads will now fit nicely in the holes left by the resistor.

Install the regulator with the markings facing the top edge of the board. Bend it forward slightly toward C16 so that there will be no height-interference problem.

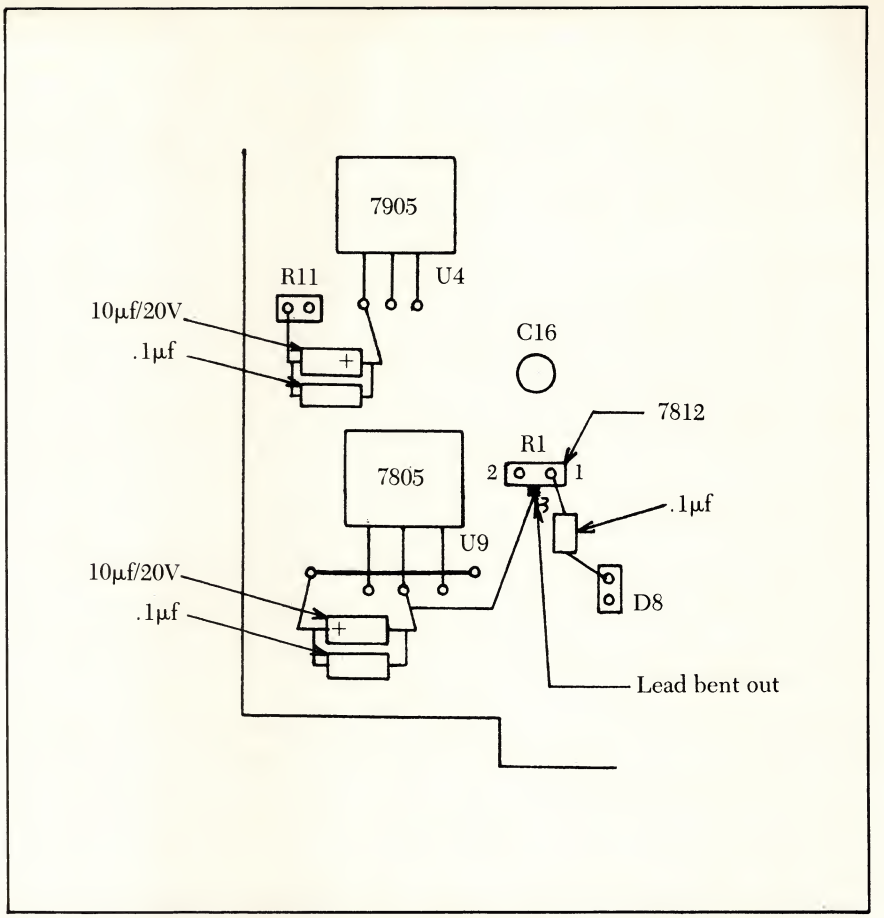

Figure 5. Placement of parts for the power-supply upgrade to the modem board.

Now solder a wire from the center lead of the MC7812 to the center lead of the MC7805 regulator, U9, just to its left. Since this regulator will be supplying only 20 milliamperes or so, it will not warm up much. So there is no need to be concerned about a heat sink for it.

Add some capacitors

The only thing left is to add some capacitors to filter out the 60-cycle hum from the power supply and to decouple any data signals. This will prevent any stability problems.

Figure 5 shows the addition of five capacitors; two each on the –16 volt line and the +12 volt line and one on the +16 volt line. These capacitors are installed as follows:

Take a .1-microfarad capacitor and piggyback it on a 10-microfarad capacitor. Solder the negative side of this combination to the lead on R11 nearest the board edge. Solder the positive end to the closest leg of the MC7905 regulator.

Make another piggyback combination with a .1-microfarad and a 10-microfarad capacitor. Solder the positive side of this combination to the

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circuit pad just to the left of the MC7805 regulator leads. The other end gets soldered to the center lead of the same regulator.

Solder a .1-microfarad capacitor between pin 1 of MC7812 and the closest leg of diode D8.

This completes the changes to the circuitry.

And plug it in

The modem board plugs into a standard S-100 bus slot in the computer. The placement is not critical. The telephone line can be plugged directly into the modem via the RJ11C jack on the top edge of the board. This connects the modem to the telephone line continuously.

As long as the modem appears to be on-hook (hung up), continuous connection should present no problem. However, there are two conditions that must be taken into account: 1) power-up in the off-hook mode; and 2) auto-answering any and all incoming calls.

Getting around off-hook on power-up

When power is first applied, the modem can be in the off-hook mode; if so, it will stay this way until it is initialized. It will stay off-hook because of the secondary off-hook control from the DTR output of the 8251A USART. The USART does not necessarily power-up with the DTR signal high, which would keep the modem on-hook.

Having the modem off-hook can be annoying if the telephone is being used by someone when you turn your computer on. The modem might think it sees a carrier signal and send its own.

There are two ways to offset this condition.

You could add a USART-initialization routine as part of a program that gets called at boot time. (In the world of the Microsoft Disk Operating System (MS-DOS), an AUTOEXEC.BAT program can be automatically executed each time the system is booted.) The USART initialization will minimize but not eliminate the condition. This is because it typically takes a few seconds for the initialization to be completed when power is first turned on. Thus the modem can still be off-hook long enough to be annoying.

The initialization would set the DTR bit high to put the modem on-hook. In the following section on software, I will show an initialization routine that can be used.

A more positive means of preventing the off-hook condition is to eliminate the modem's DTR control. This can be done by following the instructions contained in the addendum to the documentation that comes with the modem.

The instructions say to remove the "germanium diode in the center of the modem card, marked D17." I suspect they mean the 1N4148, which happens to be silicon.

Anyway, removing that diode will eliminate the DTR secondary off-hook control; this will eliminate the need for initialization to guarantee that the modem powers up in the on-hook mode.

However, that does away with what I feel can be a highly desirable feature, the secondary off-hook control discussed above. Disabling the DTR control will prevent the setting of modem features unless you disconnect the telephone line.

So, you're stuck. You have to decide which is more important: the DTR secondary off-hook control; or the assurance that the modem will power-up in the on-hook state.

Getting around auto-answer

If the telephone is left connected even when you're not using the modem, and the auto-answer has not been disabled, any incoming telephone calls will be answered by the modem. Unless you're prosperous enough to have a phone line dedicated to your computer, this can be aggravating, to say the least.

The auto-answer can be disabled by sending the modem an S=0 command. However, if you reset the modem, the auto-answer is re-enabled. Since the telephone line plugs into the board directly, it is not always easy to get at it to unplug the line. The situation is not

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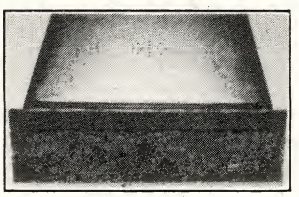

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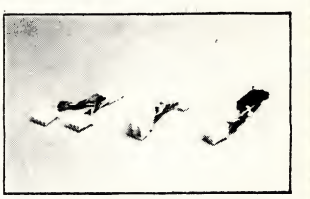

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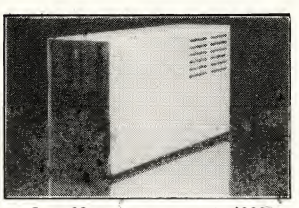

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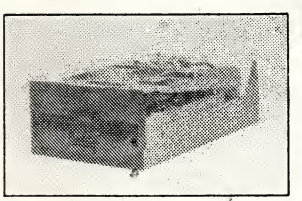

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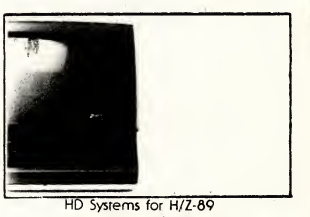

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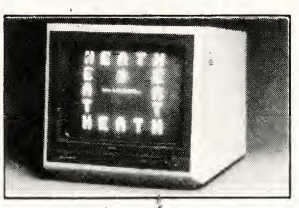

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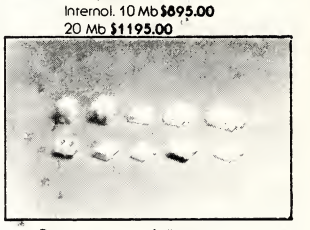

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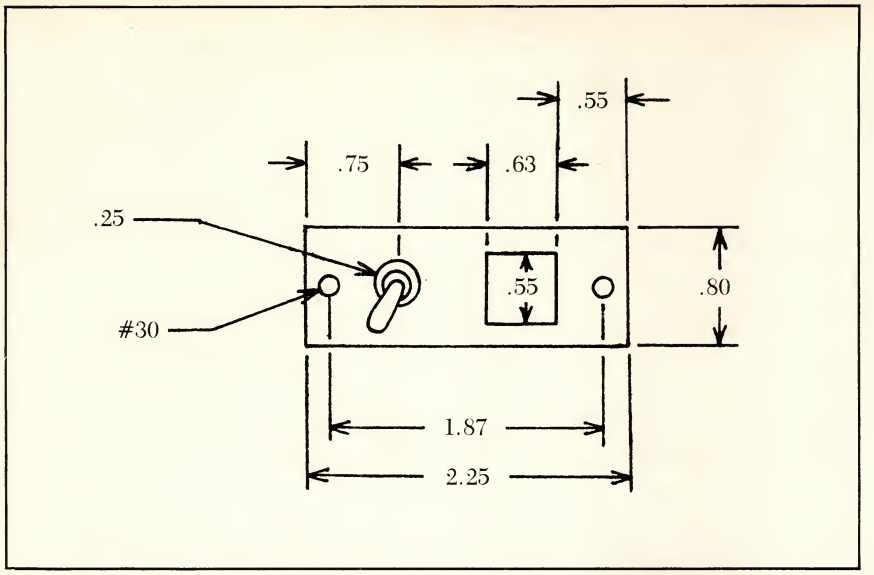

Figure 6. A plate for the switch and jack; each makes it easy to disconnect the phone line.

convenient to live with.

The solution I came up with was to add a small plate to the rear of the computer: it contains a toggle switch and a standard modular telephone jack (an RJ11C). Now I may easily disconnect the line whenever I am not using the modem. And the jack allows me to unplug the line easily if I want to move the computer.

The layout of the plate is shown in Figure 6.

The center two connections to the RJ11C jack are wired to the center terminals of a miniature double-pole toggle switch. The other side of the switch goes to a twelve-inch length of telephone cable. The red and green wires are the ones that should be wired to the switch. And there is a modular plug on the end of the cable. You can use this plug to connect to the modem board.

On the H/Z100 computer, this plate will nicely fit into an existing slot marked J17 on the rear panel. Now it becomes very convenient to connect and disconnect the telephone line from the modem. This can also be used to get around the off-hook problem discussed above.

Software

Shortly after I acquired the U.S. Robotics modem, I found that there is not a lot of software available to operate it. The reason most communications programs won't run this modem is that it needs on-board USART initialization and port addressing: this need doesn't exist in the stand-alone modem world. Most modems plug into an RS-232C port whose characteristics are fixed within system constraints.

Initially, all I wanted was to test the modem using a terminal emulator for simplicity's sake. Beautiful! In the back of the documentation is a terminal-emulator program for CP/M systems; it could be keyed in easily.

After a few minutes of "keyboarding," the emulator was in place, assembled, loaded, and running. And it just sat there doing nothing!

The time had arrived to study the code (which I should have done prior to using it, anyway).

The U.S. Robotics modem board uses an Intel 8251A USART—which is a tricky devil to get started. During ini-

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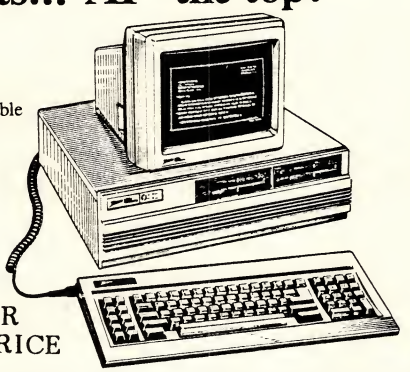

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tialization, any activity to the USART must have a delay of at least six clock pulses between write instructions (outputs). And it needs an eight-clock-pulse delay after the mode has been selected.

My experience with this device is that a six-clock-pulse delay is marginal. Even eight is not enough in all cases. (The initialization in the terminal emulator from U.S. Robotics had none at all!) If you don't use a long enough delay, funny things happen. Sometimes, the device works all right; other times, it will freeze up altogether.

The changes that I made to the routine were to add 16 clock delays between writes to the USART. This has worked in the past with 8251As, and it certainly works here. All it takes is adding one instruction after each output instruction and a two-byte storage location somewhere near the end.

The revised initialization routine is incorporated in the program shown in Listing 1. These changes should be made to the U.S. Robotics terminal-emulator program if you wish to use that.

The sound quality is improved to the point where it is hard to beat.

The program shown in Listing 1 can be modified and/or set up for various modes. It is set at 300 baud, but you can change that if you wish.

The port selection at the very beginning may have to be changed depending on the computer configuration you are using. In my case, I use Port 0 and Port 1 for data and control respectively.

The program should be assembled, loaded, and renamed to whatever you wish. It can be run at each boot-up to ensure that the USART gets initialized to keep the telephone on-hook, if nothing else.

```
; THIS IS INTEL 8251A USART INITIALIZATION ROUTINE
;
; THE MODEM PORT IS SET AT 00, 01 FOR THE H/Z-100.
;
MODDATP:EQU     000H            ; DATA PORT
MODCTLP:EQU     001H            ; CONTROL PORT
;
SXTNMB: EQU     04EH            ; MODE BYTE FOR 600, 1200 BAUD
                                ; 1 STOP BIT, NO PARITY, 8 BITS, 1/16 CLOCK
;
SXTRMB: EQU     04FH            ; MODE BYTE FOR 150, 300 BAUD
                                ; 1 STOP BIT, NO PARITY, 8 BITS, 1/64 CLOCK
;
HSCMDB: EQU     037H            ; COMMAND BYTE FOR 300, 1200 BAUD
                                ; RTS HI, DTR HI, TRANS + RECV ENABLE
;
LSCMDB: EQU     017H            ; COMMAND BYTE FOR 150, 600 BAUD
                                ; RTS LO, DTR HI, TRANS + RECV ENABLE
;
RESET:  EQU     040H            ; USART RESET CODE
;
BOOT:   EQU     000H            ; OPERATING SYSTEM BOOT
;
        ORG     100H            ; FOR CP/M AND MS-DOS SYSTEMS
;
; THE 8251A USART REQUIRES AN INTRICATE INITIALIZATION SEQUENCE.  IT NEEDS THREE
; NULL BYTES AFTER POWER UP TO PUT IT IN A KNOWN COMMAND MODE STATE.  THIS IS
; FOLLOWED BY A RESET WHICH MUST BE FOLLOWED BY MODE SELECTION AND THEN THE
; COMMAND BYTE.  THE FUNNY THING IS THAT THE 8251A REQUIRES SIX CLOCKS BETWEEN
; WRITES DURING INITIALIZATION, AND IT NEEDS EIGHT CLOCKS AFTER THE MODE HAS BEEN
; SELECTED.  DON'T SKIMP HERE OR YOU'RE IN FOR SOME STRANGE HAPPENINGS.
;
        XRA     A               ; CLEAR USART
        OUT     MODCTLP         ; ONCE
        SHLD    DELAY           ; ADD A LITTLE DELAY FOR USART
        OUT     MODCTLP         ; TWICE
        SHLD    DELAY
        OUT     MODCTLP         ; THREE TIMES
        SHLD    DELAY
        MVI     A,RESET         ; RESET USART
        OUT     MODCTLP
        SHLD    DELAY
        MVI     A,SXTRMB        ; 300 BAUD, ETC.
        OUT     MODCTLP
        SHLD    DELAY
        MVI     A,HSCMDB        ; 300 BAUD, ETC.
        OUT     MODCTLP
        SHLD    DELAY
        JMP     BOOT            ; JUMP TO OPERATING SYSTEM
;
DELAY:  DS      2               ; DUMMY STORAGE
;
        END
```

Listing 1. If you wish to use the U.S. Robotics terminal-emulator program on the Z100, you must add this revised initialization routine for the modem's 8251A USART.

MODEM7 on the '100

Now the terminal emulator worked and allowed a thorough checkout of the features of the modem. So, the next step was to find a complete communications program for the U.S. Robotics modem that could rival the MODEM7 programs written by Ward Christensen for the general CP/M world. I found just the package I was looking for when I checked with Dan Gentile, system operator of the local Heath bulletin board at the Heath/Zenith store in Wellesley, Massachusetts.

This package is an overlay which modifies the MODEM7 series of modem programs; written by Irv Hoff and updated by Phil Lapsley, it gives MODEM7 programs the capability to run with the U.S. Robotics S-100 bus modem.

The program is M7US-1.ASM and is available on many bulletin boards, including the Wellesley Heathkit board. Directions for using the program are included in its heading information.

M7US-1 does not make use of the modem's secondary hook switch control; but other features, such as control-N for hang-up, work great. And it works without using the S-100 bus interrupts. Thus, those pesky open-collector driver transistors can be ignored for the present.

The initialization routine in this overlay program needed to be reworked to increase the delays. The copy available on the Wellesley Heathkit board contains the changes I made to correct these delay times. I also incorporated some additional code to set the modem, whenever it is initialized, for 1200 baud, echo back, no auto-answer, and extended messages.

Conclusion

The U.S. Robotics modem has given me no trouble since I made the hardware and software changes described above. I would highly recommend it to anyone. I am very pleased with its overall operation under CP/M.

My next project is to get the modem to run under MS-DOS. Since I found a copy of MODEM7.ASM re-done for MS-DOS, incorporating the initialization and port assignments should be relatively straightforward.

All I need to do is find the time. . . .

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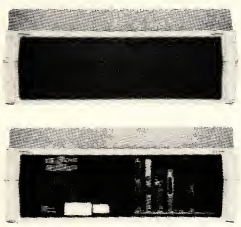

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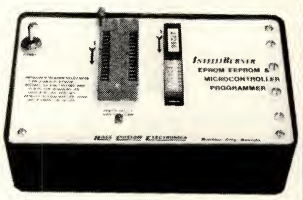

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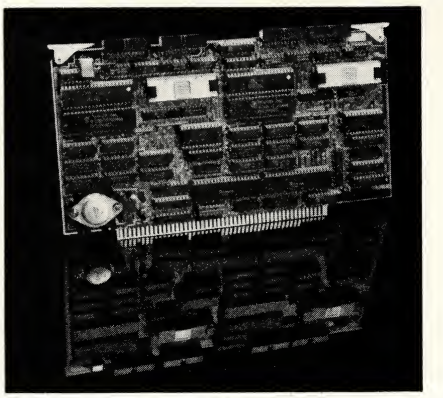
Supplier Notes

CPS-216 Offers Two 8086 Slaves for Z100



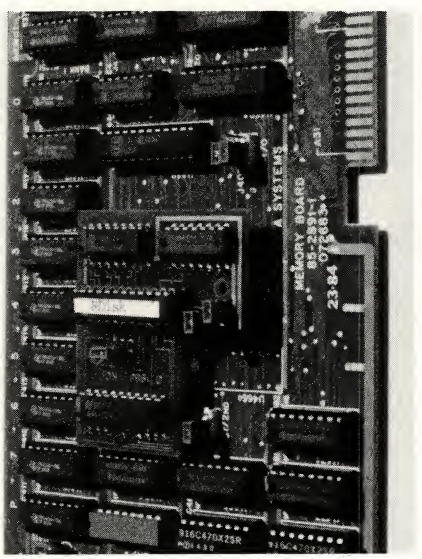
CPS-216, a new product from Inter-Continental Micro (ICM) is a single-board computer with two 16-bit, 8-MHz, 8086 slave processors. It allows for twice the number of users your existing chassis can support. Both slaves give true 16-bit performance with 256K RAM.

The CPS-216 is an intelligent interface to a wide range of peripherals. It is fully compatible with IEEE 696.1/D2 S-100 bus specifications. It interfaces with ICM's CPZ-186 (16-bit) or CPZ-4800X (8-bit) master processors. Because the CPS-216 is an I/O-mapped slave, it can also be integrated with a Z80 or 16-bit based CPU complying with the IEEE 696.1/D2 S-100 bus standard.

Operating under TurboDOS, the CPS-216 can be mixed with 8-bit Z80-based slaves and 16-bit 8086 or 80186 slaves on the same bus. With use of ICM's Turbo-LAN, it is possible to build a 4,000-user network by linking fileservers. Up to 255 S-100 bus slaves, Z100s, IBM PCs, XTs, ATs, jrs, or PC compatibles can be linked together.

Software selectable communications speeds of up to 1 megabaud eliminate costly, complicated hardware modifications to change baud rates.

For further information, contact Steve Rasmussen or Don Shulz at Inter-Continental Micro, 4015 Leaverton Court, Anaheim, CA 92807. Phone: 714/630-0964.



RDisk Increases Z150's Memory, Saves Time

RDisk is a new product from KCI, inc. It is designed to allow the computer to use as much as 5,120 Kbytes of memory. Used as a RAM drive, it can reduce the amount of time spent waiting for floppy disks to load.

RDisk is a daughter board which may be installed on a Z150/160 memory board. Each RDisk can support five memory banks. Since each bank holds a set of nine 256-Kbit chips, one RDisk may hold 1,280 Kbytes (5 x 256 Kbytes). Of this, MS-DOS can support up to 640 Kbytes.

A total of four Z150/160 memory boards can be installed with RDisk. This means the system has the potential to have a total of 5,120 Kbytes (640 Kbytes for MS-DOS and 4,480 Kbytes of RAM disk).

RDisk is one contiguous RAM disk. Storage is actually in the chips, as opposed to being on disks. Thus, time normally spent waiting for floppy disks is reduced, while memory is increased. For example, KCI reports that loading WordStar from a floppy disk takes 12 seconds; with RDisk, the same procedure takes less than 2 seconds.

The RDisk package costs $99, and includes the board equipped with all the appropriate hardware, a diskette containing RAM-disk software, and full instructions. Installation requires only a screwdriver (no soldering), and involves removing several chips, plugging the board into the sockets, and replacing the chips. For more information, contact KCI, inc., P.O. Box 3344, Ann Arbor, MI 48106, 313/665-7107.

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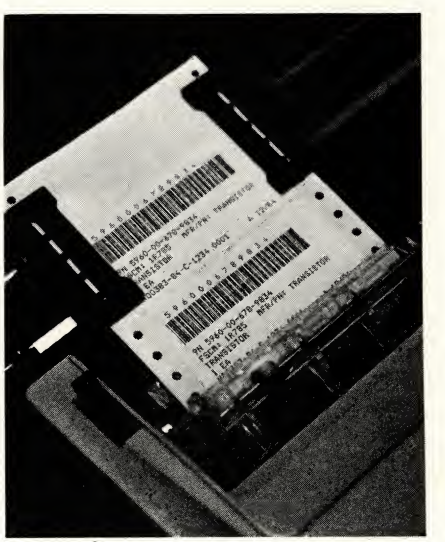

CLS & Associates, Inc. has announced the release of BarCode PrintMaster I. The program runs on many computer/printer combinations and is capable of printing the barcode labels required by most Department of Defense and GSA contracts. The program requires no additional hardware and uses standard self-adhesive labels available from most office product outlets.

BarCode PrintMaster I is in full compliance with all current government regulations, and CLS offers a program maintenance agreement for $15 per year in which revisions and updates will be distributed automatically upon release.

The program currently runs on IBM PC compatibles and on the Zenith Z100 series (both with 64K RAM and at least 1 disk drive). The following printers are also currently supported: the Epson MX series (with Graftrax); the Epson RX and FX series; the Okidata µ82 and 83 (with dot graphics); the MPI 350; and the Mannesmann Tally 160 and 180.

BarCode PrintMaster I is distributed on a single DS/DD diskette in compiled BASIC without copy protection. The program is menu-driven, self-prompting, and is accompanied by a user's manual. The program is priced at $149, with a demonstration disk and manual available for $15. For further information, contact CLS & Associates, Inc., 10651 East Bethany Drive #200, Aurora, CO 80014, 303/755-4127.

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VISA and MASTERCARD

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BASIC Questions and Answers

Edward A. Byrnes

Semi-sorting files from within BASIC

Graphically displaying trigonometric functions

Mixing colors on the Z150

Picking random numbers for the state lottery

Photo by Charles Floto

Trigonometric functions can be plotted under BASIC and displayed on the screen. This display resulted from running FN4.BAS in Listing 2.

Greetings everyone! Here's the second column of BASIC Questions and Answers. The questions this issue include ones about lotteries, BASIC directories, function plotting, and mixing colors on the Z150.

The answer to each question is one solution out of the many possible. If you have a better, faster method of doing the same operation, or even a more novel approach, I encourage you to write and share your methods.

Questions and short listings outlining the question can be sent on paper or disk. If you send a disk, please specify the operating system used, and include a stamped disk mailer if you wish the disk to be returned. The column covers Microsoft BASIC, Z-BASIC, and GW BASIC (BASICA.EXE) questions.

Send your questions to: BASIC Questions and Answers, 412 Taylor Street, Rochester, MI 48063-4327. Thanks.

Soft-sectored disks can hold so many files that it is a task at times to find a particular file using the FILES command from within BASIC. Is there any way to get a listing of the files in alphabetical order?

A program that would completely alphabetize the files from within BASIC would be restrictingly slow. The Semi-Sorted BASIC Directory program given in Listing 1 isn't as slow, but it will still help you find files quickly.

The program is DIR.BAS. It achieves the result of a sort by listing all the files beginning with "A", then doing the same for each succeeding letter of the alphabet. After you run DIR.BAS, all the BASIC file names for each letter will be on one or two lines. (Unless you begin all your file names with the same letter.)

Examination of the program reveals that it uses the FILES command to pull all the .BAS file names that begin with N$. The ASCII value of N$ is increased by 1 until the value of X reaches 27. Each time the process repeats itself, N$ is equal to another of the letters A-Z. (See lines 12 and 14.)

The NEW command on line 14 keeps the user from having to remember to type in NEW in order to get rid of DIR and begin a new program. The use of the NEW command is hazardous, though. If you run the program before having saved it, everything you have typed will be lost in memory land. So, each time you modify the program, be sure to SAVE it before you RUN it.

The same program will run under GW BASIC on the Z150. If you insert SCREEN 2: before the CLS command in line 10, you will ensure yourself a semi-sorted listing of the files in the 80-column high-res mode.

DIR.BAS can be particularly helpful when called up when you load Z-BASIC or GW BASIC.

Just type ZBASIC DIR or BASICA DIR for a semi-sorted directory of the files when

```
5 REM ***** SEMI-SORTED BASIC DIRECTORY *****
10 CLS:ON ERROR GOTO 40
12 N$=CHR$(65+X)
14 X=X+1:IF X>26 THEN NEW:END
20 FILES N$+"???????.BAS":ON ERROR GOTO 40
30 GOTO 12
40 RESUME 12
```

Listing 1. DIR.BAS will work within either Z-BASIC or GW BASIC to produce a "semi-sorted" directory of all .BAS files on the default drive. Files will be listed in order based on the first letter of the file name. Within a given letter, the files will be in whatever order they appear in the disk directory.

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```
100 REM <<<                                          >>>
110 REM <<<     FN4.BAS  ZBASIC VER. FOR Z-100       >>>
120 REM <<<     Generates graphic representations    >>>
130 REM <<<     of four functions.  Original sine    >>>
140 REM <<<     program by Chris Lynn.               >>>
150 REM <<<                                          >>>
160 DEFDBL Z:CLS
170 DEF FNE(X)=SIN(X)*25:DEF FNF(N)=TAN(N)*25
180 DEF FNG(P)=COS(P)*25:DEF FNT(S)=ATN(S)*25
190 LINE(312,0)-(312,224),1:LINE(0,112)-(639,112),1
200 DEF FNX(X)=(X*2)+312: DEF FNY(Y)=-Y+112
210 FOR A=-156 TO 156 STEP .2
220 ZZ$=INKEY$:IF ZZ$<>"" THEN COLOR 6,0:CLS:LOCATE ,,1:END
230 X=A/10:N=A/10:P=A/10:S=A/10:Z=FNE(X):H=FNF(N):I=FNG(P):J=FNT(S)
240 COLOR 6:LOCATE 2,70
250 LOCATE 20,1:PRINT "YELLOW = SINE":COLOR 4:PRINT"RED = TANGENT"
260 COLOR 3:PRINT "CYAN = COSINE":COLOR 5:PRINT "MAGENTA = ARCTANGENT"
270 COLOR 6:IF ABS(Z)>700 THEN 300
280 PSET (FNX(A).FNY(Z)).6:PSET (FNX(A).FNY(H)).4
290 PSET (FNX(A).FNY(I)).3:PSET (FNX(A).FNY(J)).5
300 NEXT:LOCATE 1.1.0:ZZ$=INPUT$(1):LOCATE ..1
```

Listing 2. FN4.BAS **gives a graphic plot of Z-BASIC's sine, cosine, tangent, and arctangent functions. Each function is plotted in a different color. (The GW BASIC version is given in Listing 3.)**

```
100 REM <<<                                          >>>
110 REM <<<     FN4GW.BAS GWBASIC VER. FOR Z-150     >>>
120 REM <<<     Generates graphic representations    >>>
130 REM <<<     of four functions.  Original sine    >>>
140 REM <<<     program by Chris Lynn.               >>>
150 REM <<<                                          >>>
160 DEFDBL Z:SCREEN 2:CLS
170 DEF FNE(X)=SIN(X)*25:DEF FNF(N)=TAN(N)*25
180 DEF FNG(P)=COS(P)*25:DEF FNT(S)=ATN(S)*25
190 LINE(312.0)-(312.224).1:LINE(0.112)-(639.112).1
200 DEF FNX(X)=(X*2)+312: DEF FNY(Y)=-Y+112
210 FOR A=-156 TO 156 STEP .2
220 ZZ$=INKEY$:IF ZZ$<>"" THEN CLS:LOCATE ..1:END
230 X=A/10:N=A/10:P=A/10:S=A/10:Z=FNE(X):H=FNF(N):I=FNG(P):J=FNT(S)
240 LOCATE 1.5:PRINT "TANGENT":LOCATE 20.20:PRINT "ARCTANGENT"
250 LOCATE 18.3:PRINT "SINE":LOCATE 11.5:PRINT "COSINE"
260 IF ABS(Z)>700 THEN 290
270 PSET (FNX(A).FNY(Z)):PSET (FNX(A).FNY(H))
280 PSET (FNX(A).FNY(I)):PSET (FNX(A).FNY(J))
290 NEXT:LOCATE 1.1.0:ZZ$=INPUT$(1):LOCATE ..1
```

Listing 3. FN4GW.BAS **is the GW BASIC version of Listing 2. Instead of displaying the trigonometric functions in different colors (as in the Z-BASIC version), this program labels each function.**

you begin.

Line 9 below can be added to the GW BASIC version.

```
9 KEY OFF:KEY 10, "SCREEN 2"
```

This will turn off the 25th line's display of GW BASIC's standard function-key assignments, and set up function key 10 to send SCREEN 2. Even though DIR.BAS will be cleared from memory by the NEW statement, this function-key setup will stay. If you later go into the medium-resolution mode while writing programs, F10 will now let you quickly get back to the high-resolution mode of display.

How can Z-BASIC be used to graphically present the sine and cosine and other trigonometric functions? This would really interest math students. Any ideas?

Here are two programs that will plot BASIC's sine, cosine, tangent, and arctangent functions in x-y coordinates. The programs are FN4.BAS for the Z100 (Listing 2) and FN4GW.BAS for the Z150 (Listing 3). (In these programs, I incorporated ideas of Chris Linn for plotting the functions. See "Z-BASIC Power to the Rescue," by Terry Jensen in *REMark* #39, April 1983.)

The Z100 version features an assigned color for each plotted function; the Z150 version labels each curve with the appropriate function name.

The DEF FN statement is used in lines 170 and 180 to define and assign a variable name to each function; line 190 draws the x-y axes in each version.

Line 230 in each version defines the x-y coordinates and brings them into range for plotting.

Lines 280 and 290 (Z100 version) and lines 270 and 280 (Z150 version) do the actual plotting of the functions.

In your previous column, you showed how to mix the Z100's eight colors in Z-BASIC to produce still more colors. Can the same thing be done with the two

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three-color palettes on the Z150?

The program 9COLORS.BAS (Listing 4) will mix the three foreground colors to create six new colors for either three-color palette. The new colors are far from brilliant, but they can be used successfully in many applications, including shading.

The first part of the program, lines 160-180 and 230-270, mixes pixels of three two-color combinations. The program does this by using the PSET command to color every other pixel on every other line.

The pixels between these are in turn PSET to another color. A rectangle of each color combination is then saved by using the DIM and GET statements.

Lines 190-210 and 280-360 mix different combinations of the three palette colors by coloring every third pixel on every third line. The values of A, B, and C can be any combination of the numbers 0 to 3 to produce even more combinations of color.

Using zero (black) produces somewhat muddy-looking colors, but all colors can be used to fill the screen.

Once the screen is filled, an outline of an object can be drawn, the screen can be painted up to the border of the object, and the object can be saved for later use with the DIM and GET statements.

(More information on this technique of color mixing can be found in the "BASIC Questions & Answers" column in the September-October 1985 issue of *Sextant*.)

```
100 REM <<<                                  >>>
110 REM <<<    9COLORS.BAS   GWBASIC  Z-150    >>>
120 REM <<<    Mixes available colors to      >>>
130 REM <<<    make 6 new colors per palette. >>>
140 REM <<<                                  >>>
150 CLS:SCREEN 1.0:COLOR 0.0:REM  Change to COLOR 0.1 for second palette.
160 A=1:C=3:GOSUB 230:DIM A#(100):GET(309.100)-(316.108).A#:CLS
170 A=2:C=3:GOSUB 230:DIM B#(100):GET(309.100)-(316.108).B#:CLS
180 A=2:C=1:GOSUB 230:DIM C#(100):GET(309.100)-(316.108).C#:CLS
190 A=1:B=2:C=3:GOSUB 280:DIM D#(100):GET(309.100)-(317.109).D#:CLS
200 A=1:B=1:C=3:GOSUB 280:DIM E#(100):GET(309.100)-(317.109).E#:CLS
210 A=2:B=2:C=3:GOSUB 280:DIM F#(100):GET(309.100)-(317.109).F#:CLS
220 GOTO 380
230 FOR X=1 TO 24 STEP 2:FOR Y=1 TO 10 STEP 2:PSET(300+X.100+Y).A:NEXT:NEXT
240 FOR X=1 TO 24 STEP 2:FOR Y=1 TO 10 STEP 2:PSET(301+X.101+Y).A:NEXT:NEXT
250 FOR X=1 TO 24 STEP 2:FOR Y=1 TO 10 STEP 2:PSET(301+X.100+Y).C:NEXT:NEXT
260 FOR X=1 TO 24 STEP 2:FOR Y=1 TO 10 STEP 2:PSET(302+X.101+Y).C:NEXT:NEXT
270 RETURN
280 FOR X=1 TO 25 STEP 3:FOR Y=1 TO 11 STEP 3:PSET(300+X.100+Y).A:NEXT:NEXT
290 FOR X=1 TO 25 STEP 3:FOR Y=1 TO 11 STEP 3:PSET(301+X.101+Y).A:NEXT:NEXT
300 FOR X=1 TO 25 STEP 3:FOR Y=1 TO 11 STEP 3:PSET(302+X.102+Y).A:NEXT:NEXT
310 FOR X=1 TO 25 STEP 3:FOR Y=1 TO 11 STEP 3:PSET(301+X.100+Y).B:NEXT:NEXT
320 FOR X=1 TO 25 STEP 3:FOR Y=1 TO 11 STEP 3:PSET(302+X.101+Y).B:NEXT:NEXT
330 FOR X=1 TO 25 STEP 3:FOR Y=1 TO 11 STEP 3:PSET(303+X.102+Y).B:NEXT:NEXT
340 FOR X=1 TO 25 STEP 3:FOR Y=1 TO 11 STEP 3:PSET(302+X.100+Y).C:NEXT:NEXT
350 FOR X=1 TO 25 STEP 3:FOR Y=1 TO 11 STEP 3:PSET(303+X.101+Y).C:NEXT:NEXT
360 FOR X=1 TO 25 STEP 3:FOR Y=1 TO 11 STEP 3:PSET(304+X.102+Y).C:NEXT:NEXT
370 RETURN
380 REM CREATE AND PLACE NEW COLOR BLOCKS FOR COMPARISON
390 FOR X=1 TO 7:FOR Y=1 TO 6:PUT(30+8*X.4+8*Y).A#:NEXT:NEXT
400 FOR X=1 TO 7:FOR Y=1 TO 6:PUT(120+8*X.4+8*Y).B#:NEXT:NEXT
410 FOR X=1 TO 7:FOR Y=1 TO 6:PUT(210+8*X.4+8*Y).C#:NEXT:NEXT
420 LOCATE 9.8:PRINT "1.3        2.3        2.1"
430 FOR X=1 TO 6:FOR Y=1 TO 5:PUT(30+9*X.70+9*Y).D#:NEXT:NEXT
440 FOR X=1 TO 6:FOR Y=1 TO 5:PUT(120+9*X.70+9*Y).E#:NEXT:NEXT
450 FOR X=1 TO 6:FOR Y=1 TO 5:PUT(210+9*X.70+9*Y).F#:NEXT:NEXT
460 LOCATE 17.7:PRINT "1.2.3      1.1.3      2.2.3"
470 LINE(40.140)-(90.185).3.BF
480 LINE(130.140)-(182.185).2.BF
490 LINE(220.140)-(272.185).1.BF
500 LOCATE 25.7:PRINT "PURE      PALETTE     COLORS";:LOCATE 1.1:ZZ$=INPUT$(1)
```

Listing 4. 9COLORS.BAS is a GW BASIC program to create six new colors from either of the '150's palettes of three foreground colors.

For those who play their state lottery every week, it would be nice have their computer pick the winning numbers. I need six different random numbers between 1 and 40. Thanks.

Two programs are listed here to generate six personalized random numbers between 1 and 40 inclusive. The programs can also be modified for almost any type of state-lottery game. I can't guarantee the generation of winning numbers, but the numbers will be fairly random.

LOTTERY.BAS, in Listing 5, will work for Z-BASIC and GW BASIC; LOTTER1.BAS (Listing 6) is written for Microsoft BASIC.

In the Z-BASIC version, the RANDOMIZE statement uses the seconds value of the clock for the seed; in the MBASIC version, it uses the value of the tic counter.

Six different seed values are looked at and used in the loop in line 170. The values are also examined at random times by the use of the delay in line 240.

The variable P is defined as:

```
P=INT(RND*5)+INT(AGE/10)*500
```

The value of P is then used in the delay loop:

```
FOR N=1 TO P:NEXT
```

Random numbers generated by most computers are really pseudo-random; therefore, the use of the delay loop gives our pseudo-random numbers a greater chance of approaching "true" random values.

The age of the person seeking the numbers is asked for in line 140; it is then used in calculating the delay time between the acceptance of seed values for the random-number generation. If nothing else, this gives a greater "psychological weight" to the set of numbers generated for a particular number seeker. (And makes it more fun.)

To make the numbers even more personal, the same idea can be used in a number of ways. For instance, an INPUT statement could ask the user for a favorite color, the response could be used to assign a value to the variable CLR$, and the value could then be used in the calculation of the value of P. (See Listing 7.)

The value of CLR$ could then be used in line 240 in the following way:

```
P=INT(RND*5)+INT(AGE/10+CLR)*500
```

```
100 REM <<<  LOTTERY.BAS  Z-BASIC/GW BASIC VERSION  >>>
110 REM <<<                                         >>>
120 REM (Rewrite this line for GW BASIC to read: 120 SCREEN 0)
130 CLS:LOCATE 4.1:INPUT "Please enter your name, Oh Lottery Number Seeker";N$
140 LOCATE 6.1:INPUT "Please enter your age, Oh Lottery Number Seeker";AGE
150 CLS:LOCATE 4.1:PRINT "Just a few seconds here while I grab your numbers..."
160 LOCATE 6.1:PRINT N$;"...YOUR LOTTERY NUMBERS ARE:"
170 FOR X=1 TO 6:RANDOMIZE VAL(RIGHT$(TIME$.2)):L=INT(RND*40)+1
180 IF X=1 THEN A=L
190 IF X=2 THEN B=L
200 IF X=3 THEN C=L
210 IF X=4 THEN D=L
220 IF X=5 THEN E=L
230 IF X=6 THEN F=L
240 P=INT(RND*5)+INT(AGE/10)*500:FOR N=1 TO P:NEXT:NEXT
250 IF A=B OR A=C OR A=D OR A=E OR A=F THEN 170
260 IF B=C OR B=D OR B=E OR B=F THEN 170
270 IF C=D OR C=E OR C=F THEN 170
280 IF D=E OR D=F THEN 170
290 IF E=F THEN 170 ELSE LOCATE 8.40:PRINT A;B;C;D;E;F
300 LOCATE 22.1.0:PRINT "Press 'N' for another set or 'E' to end.
310 ZZ$=INPUT$(1):IF ZZ$="N" OR ZZ$="n" THEN 150
320 IF ZZ$="E" OR ZZ$="e" THEN LOCATE 1.1.1:END ELSE 310
```

Listing 5. LOTTERY.BAS (for both Z-BASIC on the H/Z100 and GW BASIC on the H/Z150) produces six random numbers, using user input as a seed for BASIC's random-number generation. (The MBASIC version is given in Listing 6.)

(Since you will be increasing the second INT value of the statement, you may want to reduce the 500 to 200 or 300 to keep the delay reasonable.)

Depending on your state and the lottery game being played, you may need a greater range of numbers to pick from or a set of fewer than or more than six numbers.

For example, we can alter the program to generate three numbers from a range of 50 in the following way:

1. Change the value of 40 at the end of line 170 to 50.
2. Change the 6 to 3 in line 170.
3. Delete lines 210-230.
4. Replace lines 250-290 with the following:

```
250 IF A=B OR A=C THEN 170
260 IF B=C THEN 170 ELSE PRINT A;B;C
```

You will notice that it takes a few seconds to generate each set of numbers. This makes it look like the computer is really working on coming up with a "quality" set of numbers. The delay time can be reduced by decreasing the value of 500 in line 240.

If you have any specific questions about altering the program for your particular game, drop me a line at the address given at the beginning of this column. For a reply, send a self-addressed stamped envelope.

Winners are permitted to send up to 10% of the prize to the same address. Good Luck! △

```
100 REM <<<  LOTTERY1.BAS   MBASIC VERSION  >>>
110 REM <<<                                 >>>
120 Z$=CHR$(27):CLS$=Z$+"E":PRINT CLS$
130 INPUT "Please enter your name, Oh Lottery Number Seeker";N$
140 INPUT "Please enter your age, Oh Lottery Number Seeker";AGE
150 PRINT CLS$:PRINT "Just a few seconds here while I grab your numbers..."
160 PRINT N$;"...YOUR LOTTERY NUMBERS ARE:"
170 FOR X=1 TO 6:RANDOMIZE PEEK(11):L=INT(RND*40)+1
180 IF X=1 THEN A=L
190 IF X=2 THEN B=L
200 IF X=3 THEN C=L
210 IF X=4 THEN D=L
220 IF X=5 THEN E=L
230 IF X=6 THEN F=L
240 P=INT(RND*5)+INT(AGE/10)*300:FOR N=1 TO P:NEXT N:NEXT X
250 IF A=B OR A=C OR A=D OR A=E OR A=F THEN 170
260 IF B=C OR B=D OR B=E OR B=F THEN 170
270 IF C=D OR C=E OR C=F THEN 170
280 IF D=E OR D=F THEN 170
290 IF E=F THEN 170 ELSE PRINT:PRINT A;B;C;D;E;F
300 PRINT:PRINT "Press 'N' for another set or 'E' to end."
310 ZZ$=INPUT$(1):IF ZZ$="N" OR ZZ$="n" THEN 150
320 IF ZZ$="E" OR ZZ$="e" THEN END ELSE 310
```

Listing 6. LOTTER1.BAS is a version of LOTTERY.BAS for Microsoft BASIC under the CP/M operating system.

```
142 INPUT "What is your favorite color, Oh Lottery Number Seeker?";CLR$
144 IF CLR$="BLUE" OR CLR$="blue" THEN CLR=1
146 IF CLR$="RED" OR CLR$="red" THEN CLR=4
```

Listing 7. With the inclusion of these lines in Listings 5 and 6, the programs can ask for a user's favorite color and use this as an additional factor in producing the random numbers. More lines should be added after line 146 for the rest of the colors.

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Steven Noeller lives in Las Vegas, where he's an electronics technician with the Air Force.

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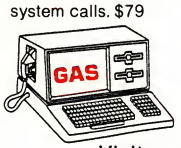

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Z-BASIC's CIRCLE Does More Than Draw Circles

Spirals, starbursts, and trig functions are just a few of the designs that can be plotted with the CIRCLE command.

Robert B. Thorne

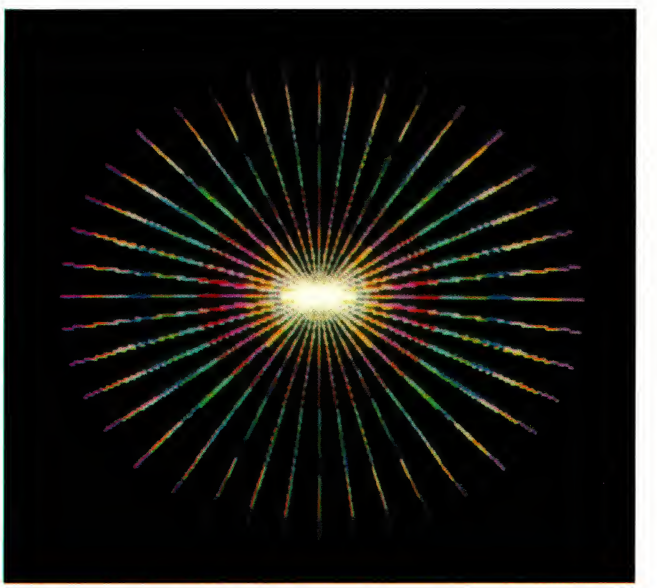

Photo by Charles Floto

Imagine that there is a single multipurpose "super" graphics command that is little known or recognized by normal, home entertainment Z-BASIC programmers such as myself. Imagine that this single command provides you with the ability to create all of the following graphic effects—and more:

* *Polar coordinate* graphing involving trigonometric and non-trigonometric functions!
* Concentric circles, with color rushing around them in both directions (clockwise and counterclockwise) at the same time!
* A screen-filling spiral in less than ten seconds! The line starts in the center and rushes around, clockwise, to fill the screen.
* A starburst in multiple overlaid colors!
* A bouncing ball that deforms the way it should when it hits the floor.

I discovered some of the many things you can do with Z-BASIC's CIRCLE command when I was thrashing around writing two programs. The first program was an "analog" clock display, with circles for the hour markers and dots marching around the face to mark minutes and seconds.

Since I'm a technical writer, not a programmer, I made lots of "interesting" mistakes. (One of them was a fairly spectacular crash involving the CIRCLE command, which stopped the program at the end of every hour. After studying the program for a while, I was able to put the graphic effect into the program while avoiding the crash.)

Later, I was looking for some little "visual trinket" to use in the second program, a spelling tutor. I started to think about my discoveries with CIRCLE in the clock program. And that got me so excited that I decided to drop everything and examine CIRCLE for a while so I could write this article. (We technical writers have unusual responses to stimulation.) And the cute little things I discovered still weren't incorporated in the spelling tutor. (Well, I'm now on the third rewrite of this article, and some special CIRCLE effects are finally incorporated in the spelling program.)

Another reason I'm so excited is that you can do so many different things with just the CIRCLE command, and you don't need a lot of "tricky" programming. I have a friend who is a professional programmer, and he loves to write code that is clean and neat; well, the concepts and approaches to these graphics effects are like that.

But before we jump into the middle of the "how to," let's review what we know about the command.

Quick, how does it run?

Remember CIRCLE's syntax and variables? Below is the way I remember them, including all of the optional items. And we certainly want to include them all! They are the keys to unlocking all of the neat (and useful) things that you can do with CIRCLE.

In the command

CIRCLE (X,Y),R,C,A1,A2,S

X = the x coordinate (in dots) of the center point;
Y = the y coordinate (in dots) of the center point;
R = the length (in dots) of the radius;
C = the color of the circle (or arc);
A1 = the angle (in radians) at which the cir-

Robert B. Thorne has been a technical writer for 15 years. He wrote manuals for Heath Company in the early 1980s, including the HERO 1 manuals. DISPLA.BAS was written on his ET-100.

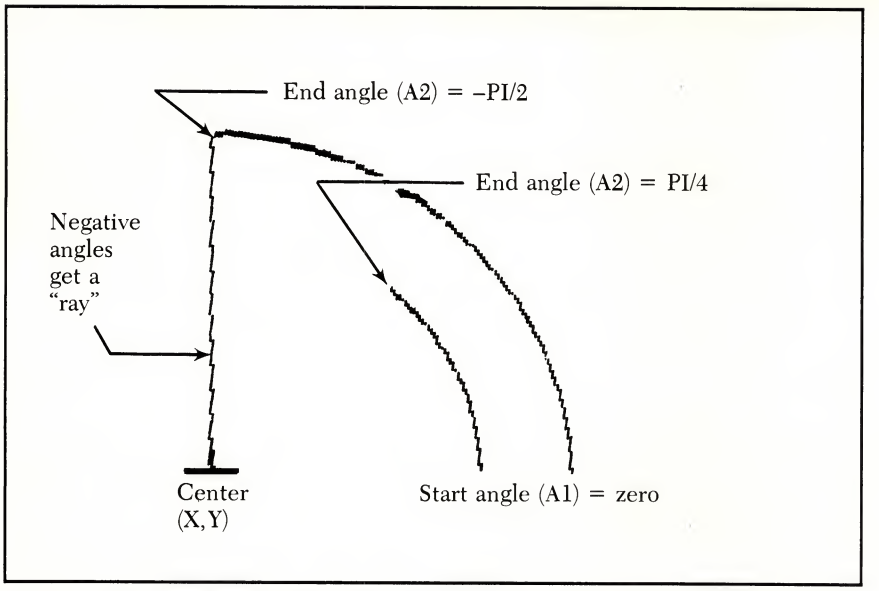

Figure 1. The CIRCLE command has several idiosyncrasies. Perhaps the most notable is that negative angles get a "ray" from the center to the end angle.

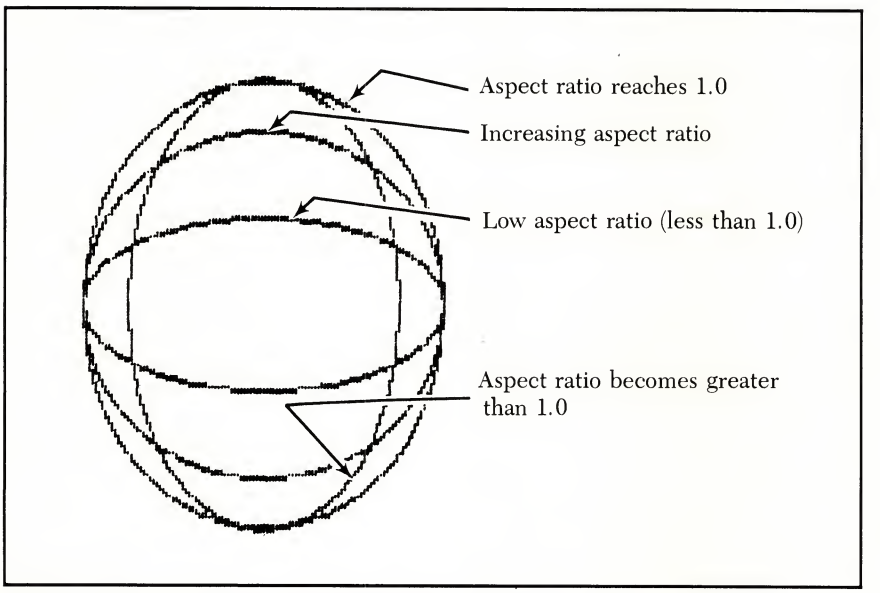

Figure 2. Changing the aspect ratio will make a circle into an oval.

cle (or arc) starts;
A2 = the angle (in radians) at which the circle (or arc) ends; and
S = the shape of the "circle" (the aspect ratio: the ratio of dots on the x axis to dots on the y axis).

Thirty seconds of theory

Before you get to play with all of the goodies, review these idiosyncrasies of the CIRCLE command. Figure 1 shows them.

First of all, the angles must be entered not in degrees, but in radians; therefore, the value of a given angle must be between +2 pi (about 6.28) and –2 pi radians. Any value outside that range will give you that old favorite "Out Of Range" error message. When you are calculating a series of revolutions and working with portions of a circle (arcs), you have to spend some time checking and correcting angles that are "greater than" 2 pi or "less than" minus 2 pi.

Second, note that zero degrees/radians is at 3 o'clock and not anywhere else that you might expect or wish it to be. This made things slightly harder for my clock program, since I was trying to start the operations at 0 (or 12) o'clock. Correcting this is a relatively simple matter of adding or subtracting pi/2 radians (90 degrees) at the appropriate point in the program.

Third, there is more of the angles' persnicketyness. Notice in Figure 1 that *both* the positive angles and negative angles are drawn counterclockwise on the screen. (What a revolting development that is!) That has a couple of effects on writing a program.

a) If you want an arc or a "ray" from the center to move clockwise from one position to the next (the way I did in my clock program), you have to remember to *subtract* a value from the current angle, not add.

b) Remember that an arc between 4 o'clock and 5 o'clock must be described as going from 5:00 (as A1 in the CIRCLE syntax) to 4:00 (as A2); if the angle started at 4:00 instead of 5:00, it would go the long way around (counterclockwise) to get to 5:00.

Fourth, the arc described with negative angles has an interesting characteristic that you can use. When either end of an arc is specified with a negative angle, that end receives a line (a radius, or "ray") from the center of the arc. (See Figure 1.) So a short arc with negative endpoints will look like a piece of pie. (And a larger arc will look like a Mr./Ms. Pacperson.)

The fifth idiosyncracy is something that will be useful if polar coordinates interest you. (Instead of the X and Y Cartesian coordinates, you use the angle and the distance from the center to describe a point.) You can do point-by-point polar graphing by using the CIRCLE command and making the arc size equal to zero (A1=A2). That lets you plot the location of a single point on the circumference.

Sixth is the shape (aspect ratio), the last variable. The default value for this is about .4375 and produces a round-appearing circle or arc. (Your Z-BASIC manual may indicate that the default is .515625; but I think you'll find that Z-BASIC itself uses .4375.)

If you use .4375, or don't specify, you will get a circle, not an oval. If you reduce the aspect ratio, the circle looks wide and short. If you increase that number, the circle looks tall and thin. (See Figure 2.)

With aspect ratios up to 1.0, the radius value in the CIRCLE command should be the desired length along the X dimension; for larger aspect ratios, you should give the desired Y dimension.

Some examples

Now, let's play with CIRCLE.

The Z-BASIC routines are strung together in DISPLA.BAS, Listing 1. Lines 10 though 80 and 2000 through 2040 provide a framework in which to place each of the applications for demonstration. There are eight applications given.

#1, lines 100-180, a polar spiral

First, how about polar coordinates? This first example is R=θ, also known as the Spiral of Archimedes. R equals the length of the radius; and θ is the angle. In other words, the length of the line is set by the angle—as the angle gets bigger, the line gets longer. It gives you the same effect as a string being unwrapped from a spool—a polar spiral.

The value of this routine is in the demonstration of polar graphing with the CIRCLE command. Interesting, isn't it? But it's slow, calculating every point separately, and if you tried to PAINT, the color would "leak" through the dots.

Well, we could use half circles to make an approximation of this spiral. That would be much faster, and PAINTable, but would not really be in polar coordinates. (The idea is used in #3, below.) If you are interested in more polar coordinates, see application #4.

#2, lines 200-340, mazes

This is the "reward" I use in the spelling program I wrote; if the student gets a score over 85%, this flashes on the screen. It puts more action on the screen than anything else I've written!

The best description I can think up is "two pin-wheels revolving in opposite directions." It uses color, but shows up well on black and white (black and amber, black and green), too.

Run the program and press "2" for *mazes*. It *amazes* me!

The value of this as a demonstration piece is to show the steps taken (in lines 240 and 250) to avoid negative values being produced for A1 and A2. The PAINT statements start the color at the center three times, and at the left edge once.

#3, lines 400-600, arc spiral

This routine draws an arc that is a quarter-circle long. Then it lengthens the radius before it continues from the end of the previous arc with another one.

In this case, of course, you lengthen the radius by extending the center end of the radius; that way, the end of the new arc will stay in place. Physically, this would be like wrapping string around a square board (instead of a round spool) and watching the arc as the string is unwrapped.

The value of this routine is in the time gained by using an approximation of a true spiral instead of the real thing; also, it shows how the radius can be lengthened. As in other sections, it's nice how much you can do with only one CIRCLE command.

#4, lines 700-800, starburst

This application reminds me of the little tissue-paper fans that you could "win" at the County Fair, in the games of "skill" up and down the midway. These little fans were dyed with bright colors and made pretty circles when you opened them into their fan-shape.

Well, you'll see what I mean when you run this part of the program. It uses the CIRCLE command with negative angles to make a "ray" from the center; but since the arc is zero, the "ray" is all there is. I think this is pretty, but it's a little slow.

Zero degrees/radians is at 3 o'clock and not anywhere else that you might expect or wish it to be.

You may note that this is like the polar-coordinate graphing applications above, except for the use of negative angles to make the "rays."

Say—that brings up an interesting question.

How about running the polar application in #1 above (and #5 below) using negative angles (to create rays, instead of just dots)? That should make the pictures different!

(Perhaps this idea could be used to make displays that look like the pictures made with the string-art kits that were popular a few years ago?)

#5, lines 900-1030, polar clover

Back again to polar graphing, and trigonometry.

There is a group of pretty figures that can be created most easily with polar coordinates. They involve the relationship between sinusoidal functions and their angles.

A typical example is a pretty five-petalled leaf, described by

$R=SIN(5\theta)$

The radius varies from minus 1 to plus 1 as the angle (θ) varies.

Since sine functions repeat themselves, you can pull off something interesting

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with this. Instead of trying to draw every point (as we did with the polar spiral), we will pick only a few points (every 1/30th of a radian) during the first pass, but we'll pick up more points on the curve every additional time it repeats.

Some of the interesting programmers' notes here include the fact that the formula uses 5θ. This means that the sine has repeated itself five times by the time the angle (θ) has reached 2 pi and begins to repeat itself. For this reason, the flower has five petals.

You can easily modify the program for a different number of petals by changing the formula in line 920. In addition, remember that half of the time SIN is negative. Z-BASIC can't do anything with a CIRCLE command with a negative radius; so I change it to plus and change the angle by 180 degrees (pi radians), in the subroutine on line 1000.

Another formula you might plug in is called a "bifolium."

$R = a * SIN\ \theta * COS\ \theta^2$

#6, lines 1100-1310, bouncing ball

With all of the things we've done using the CIRCLE command, we haven't really had many circles on the screen, have we?

Well, this application almost makes up for that, giving some honest-to-goodness circles (and a few less-than-honest circles—ovals—besides). In Z-BASIC, this routine is a little too slow for reality, but it's not bad for the fun of it.

Since the program constantly redraws the circle, you get a good chance to see how Z-BASIC's algorithm draws the circle. It works by quarters, starting each quarter-arc at the ends and proceeding towards the middle. Refer back to *Sextant* #10 for an interesting article showing how to use the coordinates for one point on a circle to determine the coordinates of seven other points. (See "Graphics Algorithm Optimized for 8080 or Z80," by David Troendle.)

The ball falls to the bottom of the screen, then deforms the way you might picture an ideal rubber ball deforming. After squashing itself a little flat, it begins to bounce back, and it actually deforms slightly in the other direction just as it

Listing 1. These eight routines show the many possible applications of Z-BASIC's CIRCLE command.

```
10 REM  DISPLA.BAS WRITTEN BY ROB THORNE
15 REM          ================ SET UP BEGINNING OF PROGRAM=======
20 R=10:PI=3.14159
30 DEFINT C,X-Z
40 CLS
50 PSET (300,110) ' MARKING THE MIDDLE OF THE SCREEN FOR CIRCLES
55 PRINT "DO YOU WANT TO SEE: POLAR SPIRAL (1), MAZES (2), ARC SPIRAL (3),"
60 PRINT "STARBURST (4), CLOVER (5), BOUNCING BALL (6), +/- ANGLE EXAMPLE (7) "
65 INPUT "OR ASPECT RATIO EXAMPLE (8)";Z
70 X=300:Y=110:CLS
80 ON Z GOTO 100, 200, 400, 700, 900, 1100, 1400, 1700


100 REM           ======================  POLAR DOT SPIRAL =======
110 A1=0: A2=A1+PI/2
120 R=R+.1 ' INCREMENT RADIUS
130 IF R>180 THEN GOTO 2000
140 A=A-.02 ' INCREMENT ANGLE (NEGATIVE TO GO CLOCKWISE)
150 IF A >2*PI THEN A=A-(2*PI)
160 IF A<0 THEN A=A+(2*PI)
170 CIRCLE (X,Y),R,,A,A
180 GOTO 120


200 REM        ====================== ARC MAZE & PAINT ============
210 CLS
220 A1=6.28:A2=6.28-PI/4:R=10
230 A1=A1-PI/2:A2=A2-PI/2:R=R+10 'INCREMENT CIRCLE SIZE, DIRECTION
240 IF A1<0 THEN A1=A1+6.28 'MUST AVOID NEGATIVE ANGLES--
250 IF A2<0 THEN A2=A2+6.28
260 CIRCLE (X,Y),R,4,A1,A2
270 IF R>160 GOTO 290 'END OF PARTIAL CIRCLES
280 GOTO 230
290 CIRCLE (X,Y),170,4,0,2*PI 'CONTAIN THE WHOLE MESS
300 PAINT (X,Y),5,4 'BEGIN THE REVOLVING COLOR
310 PAINT (X,Y),3,4
320 PAINT (132,Y),6,4
330 PAINT (X,Y),1,4
340 GOTO 2000


400 REM              ============================ARC SPIRAL===========
405 CIRCLE (X,Y),256,7 ' CONTAIN THE WHOLE MESS
410 A1=0:A2=3*PI/2
420 GOSUB 590
430 R=R+6:Y=Y-3 '    EACH OF THE FOLLOWING ADJUSTMENTS MOVES THE CENTER
440 GOSUB 520 '      OF THE NEXT ARC.  THE MOVE IS DIRECTLY AWAY FROM THE
450 R=R+6:X=X+6 '    ARC, SO THE DIRECTION OF THE ARC ISN'T ALTERED,
460 GOSUB 520 '      JUST IT'S SIZE IS.  THUS THE CURVE IS SMOOTH, BUT
470 R=R+6:Y=Y+3 '    GETS EVER BIGGER... THE NEW CENTER MOVES IN A SMALL
480 GOSUB 520 '      SQUARE, WHOSE SIZE IS THE SAME AS THE INCREASE IN
490 X=X-6: R=R+6 '   THE RADIUS SIZE.
500 GOSUB 520
510 GOTO 430
520 A2=A2-PI/2:A1=A1-PI/2 '  ADJUST THE ANGLES TO AVOID NEGATIVE ANGLES
530 IF A1>6.29 THEN A1=A1-6.28' AND ANGLES GREATER THAN 2*Pi
540 IF A1<0 THEN A1=A1+6.28
550 IF A2>6.29 THEN A2=A2-6.28
560 IF A2<0 THEN A2=A2+6.28
570 IF R>250 THEN PAINT (300,105),2,7:PAINT (300,105),5,7'TRAVELING COLOR SHOW
580 IF R>250 THEN GOTO 2000
590 CIRCLE (X,Y),R,7,A2,A1
600 RETURN
```


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```
700 REM      ================================ STARBURST ============
710 A=0
720 C=5:R=200
730 FOR N=1 TO 40 ' INCREMENT THE ANGLE OVER 40 POINTS ON THE CIRCLE
740 A=-N*PI/20
750 CIRCLE (X,Y),R,C,A,A 'DRAW RAYS FROM CENTER, SINCE ANGLE IS NEGATIVE
760 NEXT N
770 R=R-18:C=C+1' DECREMENT RADIUS, CHANGE COLOR
780 IF R<30 THEN GOTO 2000 ' STOP WHEN RAY IS LESS THAN 30 LONG
790 IF C>7 THEN C=C-7
800 GOTO 730

900 REM            ========== POLAR CO-ORDINATES CLOVERLEAF ========
910 A=.1:Z=1
920 R=250*SIN(5*A)
930 IF R<0 THEN GOSUB 1000
940 IF A>6.28 THEN A=A-6.28
950 IF A<0 THEN A=A+6.28
960 CIRCLE (300,105),R,5,A,A
970 A=A+.067:Z=Z+1
980 IF Z>820 THEN GOSUB 2000 '==== TELL IT TO STOP
990 GOTO 920
1000 REM   CORRECT FOR NEGATIVE RADIUS BY MAKING IT POSITIVE AND
1010 R=-R ' CHANGING THE ANGLE BY 180 DEGREES.
1020 A=A-3.14
1030 RETURN

1100 REM   ================================ BOUNCING BALL==========
1101 PRINT "PRESS S (THEN WAIT) TO STOP THE BALL"
1102 FOR N=1 TO 900: NEXT N
1110 Y=150: D=10 ' STARTING POINT, SIZE OF MOVE
1120 CLS: CIRCLE (300,Y),80,7,0,6.28
1130 Y=Y+D
1140 S$=INKEY$: IF S$="S" THEN GOTO 2000 '=======S FOR STOP
1150 IF Y>=179 THEN GOTO 1250  '=====BOTTOM OF SCREEN, BOUNCE
1160 IF Y<=150 THEN GOTO 1200   '====TOP OF SCREEN, REVERSE
1170 GOTO 1120
1200 REM=======REVERSE
1205 FOR N=1 TO 70:NEXT N:Y=156 '  PAUSE AT TOP OF BOUNCE
1210 D=-D' CHANGE DIRECTION
1220 GOTO 1120
1250 REM ======ADJUST SPEED (D), ASPECT (A), & ASPECT RATE OF CHANGE (DA)
1260 D=5: A=.4375: DA=.8
1270 CLS: CIRCLE (300,Y),80,7,0,6.28,A
1280 Y=Y+D:A=A*DA
1290 IF Y>210 THEN D=-D:DA=1/DA' BOTTOM OF BOUNCE
1300 IF Y<=180 THEN A=.4375:D=-10:GOTO 1120' RESET ASPECT WHEN BALL LEAVES FLOOR
1310 GOTO 1270

1400 REM  ====================== EXAMPLE FROM PLUS TO MINUS========
1410 Q=1
1430 ON ERROR GOTO 1540
1440 IF Q<0 THEN Q$="MINUS"
1450 IF Q>0 THEN Q$="PLUS"
1460 PRINT "THE ANGLE IS GOING FROM ZERO TO "Q$" 6.00 RADIANS"
1470 PRINT "PRESS F5 WHEN YOU SEE illegal function call "
1480 A1=0:A2=0
1490 FOR N=1 TO 19
1500 A2=Q*N/3
1510 CIRCLE (X,Y),120,7,A1,A2
1520 FOR M=1 TO 400: NEXT M
1530 NEXT N
1540 N=0:CLS
1550 IF Q=-1 THEN GOTO 1580
1560 Q=-1
1570 GOTO 1440
1580 CLS:PRINT:PRINT:PRINT "CIRCLE FROM MINUS .2 TO -6 RADIANS"
1590 CIRCLE (X,Y),120,2,-.2,-6
1600 CIRCLE (340,80),5,1,0,6.28
1610 PRINT "PRESS F5 TO CONTINUE"
1620 INPUT Z$
1630 GOTO 10

1700 R=80:X=200:Y=100 '   ==============SHOW ASPECT RATIO ===============
1710 CLS: KEY OFF:PRINT "PRESS ANY KEY TO INCREMENT ASPECT RATIO "
1720 N=0
1730 DA=N/10
1740 LOCATE 25
1750 PRINT "     ASPECT RATIO IS "DA"                                    "
1760 CIRCLE (X,Y),R,7,0,6.28,DA
1770 Z$=INKEY$: IF Z$="" THEN GOTO 1770
1780 N=N+1:IF N>35 THEN GOTO 1800
1790 GOTO 1730
1800 PRINT "DONE"

2000 REM        ====================== RESET SUBROUTINE ============
2010 PRINT "PRESS F5 TO CONTINUE "
2020 A=0: A1=0: A2=0
2030 BEEP
2040 STOP: GOTO 10
2050 END
```

leaves the "floor."

Being perfect, the ball continues to bounce forever. If you want it to stop, you have to press the capital "S" for stop. Then wait for the computer to complete a bounce, discover the "S", and actually respond.

#7, lines 1400-1630, + and – examples

You may be interested in a simple graphic demonstration on the screen of the positive-angle and negative-angle ("rayed") arcs. If so, enter the lines 1400-1630.

#8, lines 1700-1800, shape examples

This also is "just a display," but I think it is more interesting than application #7. It shows the circle changing shape each time you press the space bar. Each press represents a change of .1 in the aspect ratio until the ratio gets to 3.5. (I set 3.5 just as a convenient stopping point. An aspect ratio of zero gives you a horizontal line; you have to go up to 200 or so to get a straight line in the vertical.)

So there you have them

None of these displays is awe-inspiring, but they do display *everything in the world* that you can do with CIRCLE. (I used many of them when I did my "analog" clock program.)

What? You say this article *doesn't* contain *everything* in the world about CIRCLE?!

Great! I'd love to read about some other nifty tricks with CIRCLE in *Sextant*. △

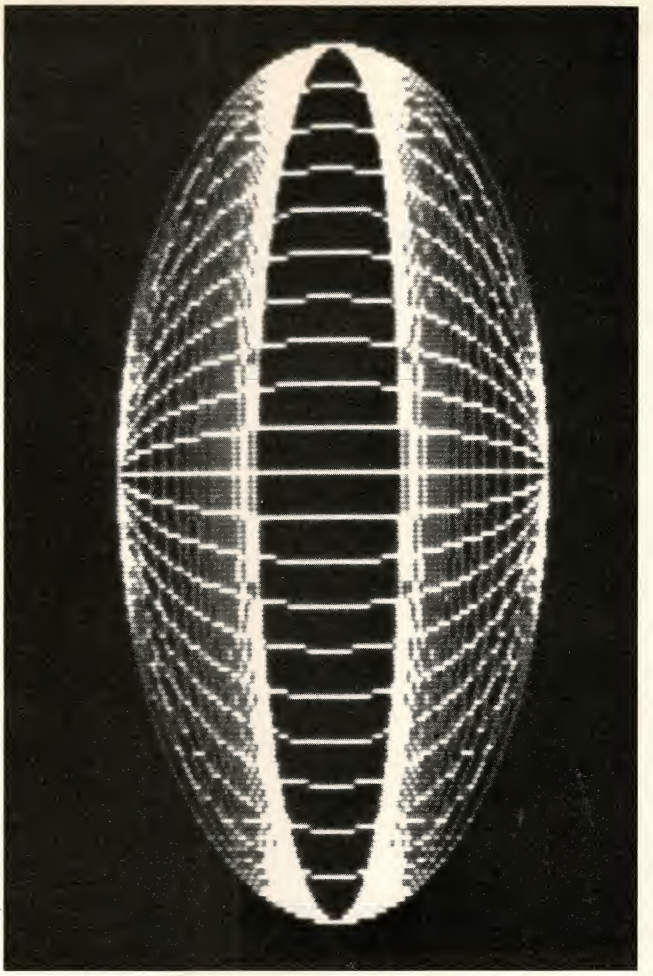

Photo by Charles Floto

In routine #8, each time you press the space bar the circle will get narrower.

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*Cromemco	1S/DD	A	A NF
*Cromemco	2S/DD	A	A NF
*Cromemco-ITC	1S/DD	A	A NF
*Cromemco-ITC	2S/DD	A	A NF
DEC VT-180	1S/DD	A NF	A NF
EPSON QX-10	2S/DD	A NF	A
Hewlett/Packard HP-125	2S/DD	A NF	A
IBM-CP/M 86	1S/DD	A NF	A
IBM-CP/M 86	2S/DD	A NF	A
*Kaypro II	1S/DD	A NF	A
Magnolia	1S/DD	A NF	A
Morrow MD2	1S/DD	A	A
*Morrow MD3	2S/DD	A	A
NCR Decision Mate V	2S/DD	A NF	A
NEC PC-8801	2S/DD	A NF	A
NEC PC-8001A	1S/DD	A NF	A
*Osborne 1	1S/SD	A	H
*Osborne 2	1S/DD	A	A
Otrona Attaché	2S/DD	A NF	A
Sanyo MBC-1000	2S/DD	A NF	A
Superbrain 40T	1S/DD	A	A
Televideo	2S/DD	A NF	A
Texas Inst Prof	1S/DD	A NF	A
Xerox 820-II	2S/DD	A NF	A NF
Zenith CP/M-80	1S/SD	A(48/96)	N
Zenith CP/M-80	2S/SD	A(48/96)	N
Zenith CP/M-80	1S/DD	A(48/96)	A(48)
Zenith CP/M-80	2S/DD	A(48/96)	A(48)
Zenith CP/M-80	1S/ED	A(48/96)	A(48)
Zenith CP/M-80	2S/ED	A(48/96)	A(48)
Zenith CP/M-85/86	1S/DD	A(48/96)	A(48)
Zenith CP/M-85/86	2S/DD	A(48/96)	A(48)

A = Available & shipping, N = Program not available, NF = No format program available, H = Hardware prevents transfer, 48 = 48 tracks/inch, 96 = 96 tracks/inch, * = Available for Z90.

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Scuttlebutt

There was talk going around the Federal Computer Conference in September of an "**eight-in-one**" **computer** from Zenith. The machine is reportedly compatible with the Z100 and the IBM PC, XT, AT, high-resolution XT and AT, and Xenix machines. (The eighth machine is the '150.) It will be promoted to the military only.

Seequa Computer Corp., mentioned here in the July-August issue, is ailing. According to an article in the August 5 issue of *ComputerWorld*, Seequa is **closing its only production facility** and letting go almost 90% of its work force. They're farming out production of the IBM-compatible Chameleon and a new product to firms in California and Mexico.

We reported that Seequa had won a contract with the U.S. Navy for up to 36,000 portable Chameleons. Their bid was based on a declining price structure; prices for the first year will be higher than those offered by other competitors for the contract, but the average price over the three years of the contract is lower. It has been speculated that Seequa planned it that way so the increased income at the start of the contract might **pull them out of their slump.**

A significant number of **layoffs and demotions** have been reported **at Heath Company**, in areas including manufacturing and non-computer engineering—as well as at the Heath Users' Group.

In a related story, **Walt Gillespie has resigned** his position as editor of *REMark*, the magazine published by HUG. Walt made no reference to the staff cut, but said, "I found I had a different perspective and priorities, so I felt it best to move on...." His resignation was effective September 1, and he headed for North Carolina shortly thereafter. We wish Walt—and *REMark*'s staff, in his absence—the best of luck.

As a result of a **dispute with Zenith Data Systems**, Morrow Inc. was forced to furlough two-thirds of its workers and stop production of the Pivot laptop portable for a week in September.

Morrow reportedly wanted to renegotiate some contract terms that required them to manufacture more Pivots for Zenith than for their own customers. (Zenith sells the machine as the Z171.)

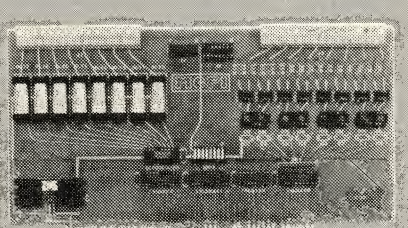
While negotiations were going on, Zenith reportedly withheld shipments of some basic components required to build the machines.

The new contract has Morrow supplying Zenith with the systems for two months while Zenith sets up its own production facilities for the machine.

Buyer beware: Software Wizardry warns us that there's a company selling a product they're calling RAMPAL. RAMPAL is the name of a memory upgrade modification engineered and sold by Wizardry for the Z100 and Z150. They've entered litigation over the matter.

We've seen ads for **ZBASIC**, a "lightning-fast" BASIC with a lightning-bolt Z in its name, from a company called Zedcor.

MULLEN S-100: Real Time, Real World CONTROLLER



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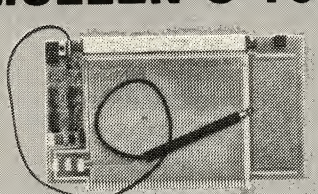
Examples of applications are included in a reprinted article that demonstrates two MULLEN CONTROLLER BOARDS in an interactive system that: feeds a cat; irrigates a garden dependent on soil moisture; closes the window when it rains; controls the thermostat for optimum comfort; controls appliances, lights, security system, and weather monitoring station (logging temperature, wind speed and direction, and graphing pollution content of the atmosphere.) Solenoids, microswitches, pneumatic actuators, pH sensors, and other devices are used in this system.

MULLEN S-100: DEBUGGERS



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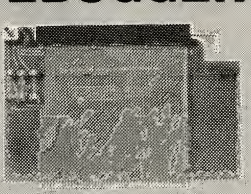

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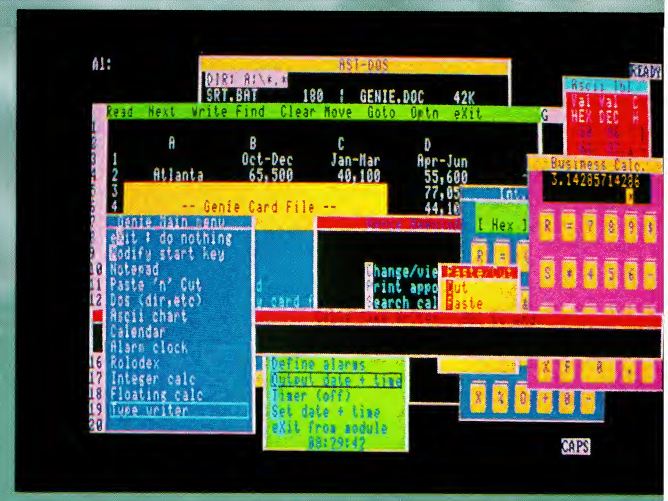

Shown here is Genie "popped up" on a Z-110 running Lotus 123. From the left are: The Genie main menu, the Genie rolodex style card file, the Genie notepad containing data cut from Lotus, the Genie DOS performing a directory command, the Genie alarm clock (at the bottom,) the Genie typewriter, Genie calendar, Genie Cut and paste, Genie Calculators, and the Genie Ascii table.

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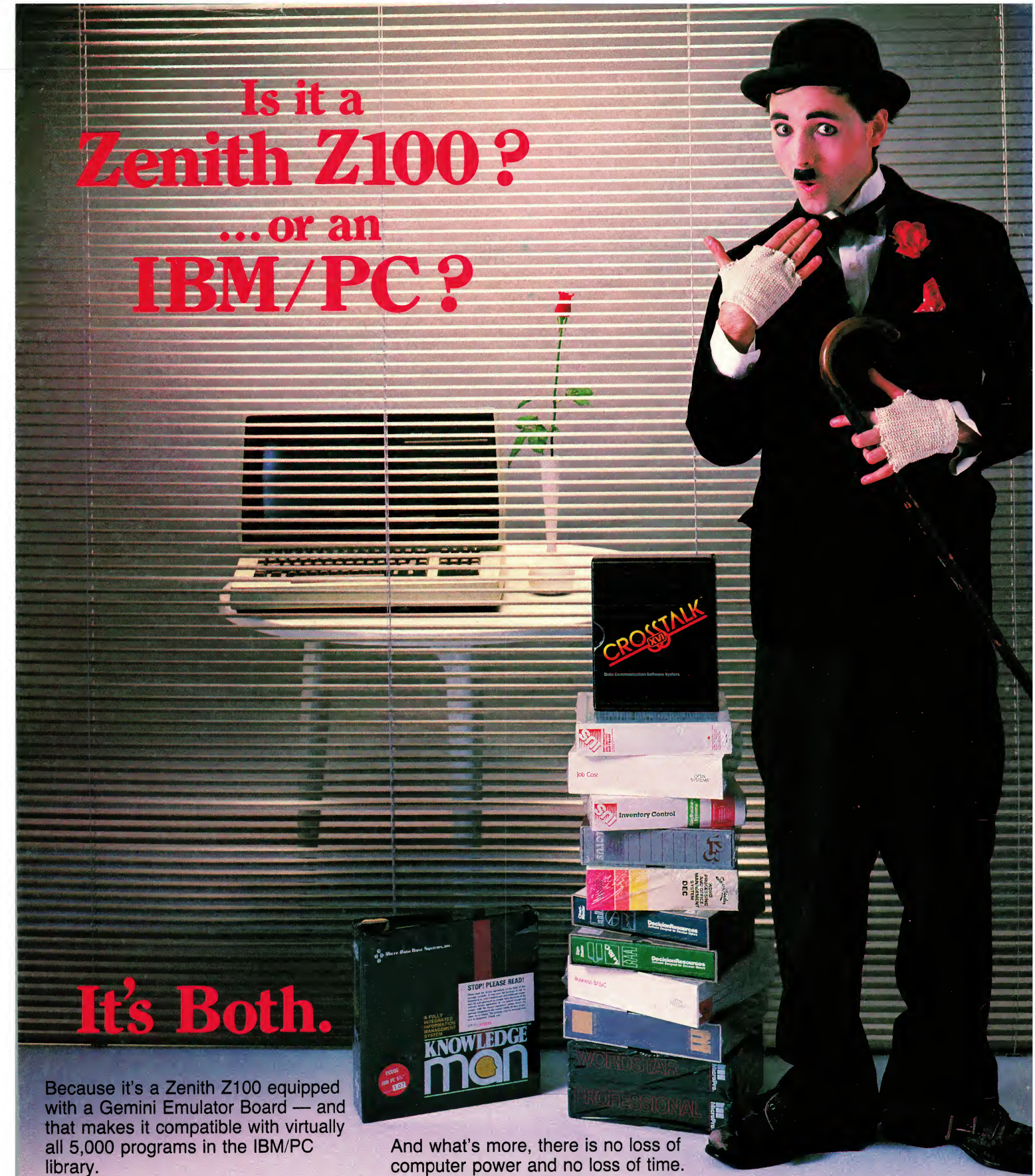

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